

Geostationary Operational Environmental Satellite (GOES)

GOES-R Series

General Interface Requirements Document (GIRD)

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to

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Table of Contents

1	SCOPE	1
1.1	Introduction.....	1
1.2	Terminology.....	1
1.3	Order of Precedence.....	2
2	Documents	2
2.1	Applicable Documents.....	2
2.2	Reference Documents	3
3	Requirements	3
3.1	General Requirements.....	3
3.1.1	Instrument Modes	3
3.1.1.1	Mode Changes External Harm.....	3
3.1.1.2	Power Off Mode	3
3.1.1.3	Instrument Safe Mode.....	3
3.1.1.3.1	Instrument Safe Mode Command	3
3.1.1.3.2	Instrument Safe Mode Timeout	3
3.1.1.4	Survival and Storage Modes	3
3.1.2	Operational Concepts.....	4
3.1.2.1	Pre-Launch.....	4
3.1.2.2	Launch and Orbit Raising	4
3.1.2.3	On-Orbit Concept.....	4
3.1.3	Dimension Standard.....	5
3.1.4	Coordinates	5
3.1.5	Yaw Flip.....	5
3.2	Interface Requirements	6
3.2.1	Mechanical.....	6
3.2.1.1	Instrument Envelopes.....	6
3.2.1.1.1	Envelope Documentation.....	6
3.2.1.1.2	Critical Clearances	6
3.2.1.2	Fields of View.....	6
3.2.1.3	Mass Properties.....	7
3.2.1.3.1	Center of Mass	7
3.2.1.3.2	Inertia Properties.....	7
3.2.1.4	Mounting.....	7
3.2.1.4.1	Hardware.....	7
3.2.1.4.2	Method	8
3.2.1.4.3	Handling Fixtures.....	8
3.2.1.4.4	Interface	8
3.2.1.4.5	Location	8
3.2.1.4.6	Drill Templates	9
3.2.1.5	Alignment	9
3.2.1.5.1	Nadir and Body-Mounted Instrument Alignment.....	9

3.2.1.5.1.1	References.....	9
3.2.1.5.1.2	Responsibilities	10
3.2.1.5.1.3	Placement	10
3.2.1.5.1.4	Initial Alignment Knowledge	10
3.2.1.5.1.5	On-Orbit Alignment Knowledge	10
3.2.1.5.1.6	Alignment Rate of Change.....	10
3.2.1.5.2	Solar Imaging Suite (SIS) Alignment	10
3.2.1.5.2.1	References.....	10
3.2.1.5.2.2	Responsibilities	11
3.2.1.5.2.3	Placement	11
3.2.1.5.2.4	Initial Alignment Knowledge	12
3.2.1.5.2.5	Alignment Rate of Change.....	12
3.2.1.6	Access	12
3.2.1.7	Attitude and Disturbances for Nadir and Body-Mounted Instruments....	12
3.2.1.7.1	Spacecraft Attitude and Disturbances	13
3.2.1.7.1.1	Attitude Error	13
3.2.1.7.1.2	Attitude Error Rate.....	13
3.2.1.7.1.3	Spacecraft Translation Acceleration Limits.....	13
3.2.1.7.2	Instrument-to-Spacecraft Disturbances.....	15
3.2.1.7.2.1	Instrument Disturbance Torque Limits.....	15
3.2.1.7.2.2	Instrument Allowable Angular Momentum.....	15
3.2.1.7.2.3	Instrument Disturbances Allocation	15
3.2.1.8	Attitude Errors and Disturbances for SIS	18
3.2.1.8.1	Spacecraft-to-Instrument Disturbances.....	18
3.2.1.8.1.1	Sun-Pointing Platform Attitude Error and Stability.....	19
3.2.1.8.1.2	Sun-Pointing Attitude Error Rate.....	19
3.2.1.8.1.3	Sun-pointing Attitude Knowledge	19
3.2.1.8.1.4	East-West and North-South Bias-pointing.....	19
3.2.1.8.2	Instrument-to-Spacecraft Disturbances.....	19
3.2.1.8.2.1	Instrument Disturbance Torque Limits.....	19
3.2.1.8.2.2	Instrument Allowable Angular Momentum.....	20
3.2.1.9	Flight and Non-Flight Equipment.....	20
3.2.2	Thermal	20
3.2.2.1	Thermal Control Concept	20
3.2.2.1.1	Independent Thermal Control Design.....	20
3.2.2.1.2	Coupled Thermal Control Design.....	21
3.2.2.2	Heat Transfer	21
3.2.2.2.1	Independent Unit - Heat Transfer	21
3.2.2.2.2	Independent Unit - Net Heat Transfer	21
3.2.2.2.3	Coupled Unit Heat Transfer.....	21
3.2.2.2.4	Coupled Unit - Net Heat Transfer.....	21
3.2.2.2.5	Coupled Unit - Heat Transfer Flux Density.....	22
3.2.2.3	Interface Temperatures	22
3.2.2.4	Temperature Monitoring.....	22

3.2.2.4.1 Mechanical Interface Temperature Monitoring	22
3.2.2.4.2 Instrument Critical Temperatures	22
3.2.2.4.3 Instrument Non-Critical Temperatures	22
3.2.2.5 Heater Power and Heater Control	22
3.2.2.6 Thermal Interfaces	23
3.2.2.6.1 Mounting Details	23
3.2.2.6.2 Contact Area	23
3.2.2.6.3 Interstitial Materials	23
3.2.2.7 Multi-layer Insulation	23
3.2.3 Instrument Electrical Power	23
3.2.3.1 Instrument Operational Power	24
3.2.3.1.1 Instrument Operational Power Distribution	24
3.2.3.1.1.1 Instrument Operational Power Lines	24
3.2.3.1.1.2 Instrument Operational Power On/Off Functionality	25
3.2.3.1.1.3 Instrument Operational Power Overcurrent Protection	26
3.2.3.1.2 Instrument Operational Power DC Voltage	26
3.2.3.1.3 Instrument Operational Power Voltage Transients	26
3.2.3.1.3.1 Instrument Operational Power Turn-On Step Load Voltage Transient	26
3.2.3.1.3.2 Instrument Operational Power Turn-Off Step Load Voltage Transient	27
3.2.3.1.3.3 Instrument Operational Power Start-up Transient	28
3.2.3.1.3.4 Instrument Operational Power Bus Short-to-Ground Voltage Transient	29
3.2.3.1.3.5 Instrument Operational Power Overvoltage Fault Transient	31
3.2.3.1.4 Instrument Operational Power Voltage Ripple	31
3.2.3.1.5 Instrument Operational Power Consumption	32
3.2.3.1.6 Instrument Operational Power Current Transients	32
3.2.3.1.6.1 Instrument Operational Power Turn-On Current Transient	32
3.2.3.1.6.2 Instrument Operational Power Turn-Off Current Transient	33
3.2.3.1.7 Instrument Operational Power Impedance	33
3.2.3.1.7.1 Spacecraft's Instrument Operational Power Source Impedance	33
3.2.3.2 Instrument Survival Heater Power	33
3.2.3.2.1 Instrument Survival Heater Power Distribution	33
3.2.3.2.1.1 Instrument Survival Heater Power Lines	33
3.2.3.2.1.2 Instrument Survival Heater Power On/Off Functionality	34
3.2.3.2.1.3 Instrument Survival Heater Power Overcurrent Protection	34
3.2.3.2.2 Instrument Survival Heater Power DC Voltage	35
3.2.3.2.3 Reserved (CCR 00009)	35
3.2.3.2.3.1 Reserved (CCR 00009)	35
3.2.3.2.3.4 Reserved (CCR 00009)	35
3.2.3.2.3.5 Reserved (CCR 00009)	35
3.2.3.2.4 Reserved (CCR 00009)	35
3.2.3.2.5 Instrument Survival Heater Power Consumption	35

3.2.3.2.6 Reserved (CCR 00009)	36
3.2.3.2.6.1 Reserved (CCR 00009)	36
3.2.3.2.6.2 Reserved (CCR 00009)	36
3.2.3.2.7 Reserved (CCR 00009)	36
3.2.3.2.7.1 Reserved (CCR 00009)	36
3.2.4 Instrument Electrical Power Grounding	36
3.2.4.1 Instrument Operational Power Grounding	36
3.2.4.2 Instrument Survival Heater Power Grounding	38
3.2.4.3 Instrument Secondary Power Grounding	38
3.2.4.4 Instrument Electrical Signal Grounding	38
3.2.4.4.1 Instrument Command Grounding	38
3.2.4.4.1.1 Instrument Pulse Command Grounding	38
3.2.4.4.1.2 Instrument Serial Command Grounding	38
3.2.4.4.1.3 Instrument Electro-Explosive Device (EED) Command Grounding	38
3.2.4.4.2 Instrument Telemetry Grounding	39
3.2.4.4.2.1 Instrument Analog Telemetry Grounding	39
3.2.4.4.2.2 Instrument Serial Telemetry Grounding	39
3.2.4.5 Instrument Electrical Accommodations	39
3.2.4.5.1 Spacecraft/Instrument Interface Harnessing	39
3.2.4.5.2 Spacecraft/Instrument Power Interface Harnessing	39
3.2.4.5.3 Spacecraft/Instrument Telemetry & Command Interface Harnessing	39
3.2.5 Command and Data Handling	39
3.2.5.1 Data Transfer Between the Instrument and Spacecraft	40
3.2.5.2 SpaceWire Layer Support	40
3.2.5.2.1 Guaranteed Delivery	40
3.2.5.3 SpaceWire Data Bus	40
3.2.5.3.1 SpaceWire Redundancy	40
3.2.5.4 Source Packet Format	40
3.2.5.4.1 Source Packet Length	41
3.2.5.4.2 Secondary Header Flag	41
3.2.5.4.3 Source Packet Secondary Header	41
3.2.5.4.4 Sequence Flags	41
3.2.5.4.5 User Defined Flags	41
3.2.5.5 SpaceWire Data Rate	42
3.2.5.6 Instrument to Spacecraft Data Volume	42
3.2.5.7 Pulse Per Second (PPS)	42
3.2.5.7.1 SpaceWire Time Code Support	42
3.2.5.7.2 PPS Signal Drift	42
3.2.5.7.3 Time Message	42
3.2.5.7.4 Time Code Format	42
3.2.5.7.5 Epoch	42
3.2.5.7.6 Distribution Timing	42

3.2.5.8 Ancillary Data.....	43
3.2.5.8.1 Ancillary Packet Rate	43
3.2.5.9 Control and Monitoring	43
3.2.5.9.1 Critical Telemetry	43
3.2.5.9.2 Critical Telemetry Analog Signals.....	43
3.2.5.9.3 Critical Telemetry Analog Signal Resolution.....	43
3.2.5.9.4 Discrete Control Signals	43
3.2.5.9.5 Discrete Monitor Signals	43
3.2.5.9.6 Critical Telemetry Signal Characteristics	43
3.2.5.9.7 Discrete Control Signal Characteristics	44
3.2.5.9.8 Discrete Monitor Signal Sink Current	44
3.2.5.9.9 Discrete Monitor ON Status.....	44
3.2.5.9.10 Discrete Monitor OFF Status	44
3.2.5.9.11 Instrument Configuration Commands.....	44
3.2.5.9.11.1 Configuration Command Definition	44
3.2.5.9.12 Stored Command Processing	44
3.2.6 Environmental Conditions	44
3.2.6.1 On-Orbit Radiation Environment	44
3.2.6.2 Launch Environment.....	44
3.2.6.2.1 Thermal Environment During Launch.....	44
3.2.6.2.2 Pressure Profile	45
3.2.6.2.3 Flight Acceleration.....	45
3.2.6.2.4 Flight Random Vibration	46
3.2.6.2.5 Flight Sinusoidal Vibration.....	47
3.2.6.2.6 Shock.....	49
3.2.6.2.7 Flight Acoustics	51
3.2.6.3 On-Orbit Environment	52
3.2.6.3.1 Acceleration	53
3.2.6.3.2 Orbital Heat Flux	53
3.2.6.3.2.1 Direct Solar Flux.....	53
3.2.6.3.2.2 Non-Cryogenic Systems	53
3.2.6.3.2.3 Cryogenic Systems.....	53
3.2.6.3.2.4 Eclipse.....	53
3.2.6.3.2.5 Lunar Eclipse	53
3.3 Attitude and Orbit Data.....	53
3.3.1 Attitude Knowledge	54
3.3.1.1 Representation.....	54
3.3.1.2 Accuracy	54
3.3.1.3 Update Rate.....	54
3.3.1.4 Latency.....	54
3.3.2 Spacecraft Angular Rate	54
3.3.2.1 Representation.....	54
3.3.2.2 Accuracy	54
3.3.2.3 Bandwidth.....	55

3.3.2.4 Update Rate.....	55
3.3.2.5 Latency.....	55
3.3.3 Spacecraft Orbit	55
3.3.3.1 Representation.....	55
3.3.3.2 Accuracy	55
3.3.3.3 Update Rate.....	56
3.3.3.4 Latency.....	56
3.4 Instrument GSE to Spacecraft I&T GSE Interface	56
3.5 Contamination Control.....	56
3.5.1 Instrument and Spacecraft Ground Processing	56
3.5.1.1 Facility Requirements	56
3.5.1.2 Ground Support Equipment Requirements	56
3.5.1.3 Purge Requirements	57
3.5.1.4 Ground Storage/Transportation Requirements	57
3.5.1.5 Pre-Launch Cleaning Access	57
3.5.2 Mission Considerations.....	57
3.5.2.1 Design	57
3.5.2.2 Mission Performance	58
3.5.2.2.1 Particulate Contamination.....	58
3.5.2.2.2 Molecular Contamination	58
3.6 Acronyms.....	58
Attachment 1 Document Change Record (DCR).....	59

1 SCOPE

1.1 Introduction

GIRD3

1.1-1

This General Interface Requirements Document (GIRD) sets forth the general, mechanical, thermal, electrical power, command and data handling and contamination control interface requirements imposed on both the instruments and spacecraft for the Geosynchronous Operational Environmental Satellite (GOES) -R Series System. It also defines the general environments to which the satellite will be subjected. The spacecraft contractor and the instrument contractor shall each meet their respective interface requirements defined in this document.

The Unique Instrument Interface Document (UIID) for an instrument defines the specific resource allocations, documents exceptions to the GIRD requirements and constraints, and defines the special requirements not specifically covered in the GIRD. The instrument contractor will create and maintain, with government approval, an Instrument Descriptive Document (IDD) which describe the detail instrument design and unique interface requirements. The GIRD, in conjunction with the UIID and the IDD establishes the instrument-to-spacecraft interface requirements.

Interface Control Documents (ICDs) will define the specific details of the complete spacecraft to instrument interface information (i.e., mechanical, electrical power, command and data handling, and thermal interfaces). These will be developed by the spacecraft contractor to document the Instrument-Spacecraft interface. The spacecraft contractor will control the ICDs and the ICDs will replace the related IDD.

1.2 Terminology

1.2-1

The term “(TBD)”, which means “to be determined”, applied to a missing requirement means that the instrument contractor determines the missing requirement in coordination with the spacecraft contractor.

The term “(TBR)”, which means “to be refined/reviewed”, means that the requirement is subject to review for appropriateness by both contractors, and subject to revision. The instrument contractor is liable for compliance with the requirement as if the “TBR” notation did not exist. The “TBR” merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a “TBR”.

An instrument may comprise more than one physical assembly, or unit. “Sensor unit” refers to the unit that contains the optics. “Instrument unit”

means the sensor unit, electronics box (if applicable), or other units of the instrument.

1.3 Order of Precedence

GIRD7 1.3-1 The order of precedence of interface requirements documents is the UIID at the highest level, followed in order by the GIRD, ICD, and IDD.

2 Documents

2.1 Applicable Documents

GIRD11 2.1-1 The following documents of the exact issue shown form a part of this GIRD to the extent specified herein. In the event of conflict between the documents referenced and the contents of this GIRD the latter **shall** be the superseding requirement.

MIL-STD-461E Aug 99 Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

ECSS-E-50-12A: Space Wire - Links, Nodes, Routers and Networks, 24 January 2003 European Cooperation for Space Standardization (ECSS)

ISO/DIS 14644-1: Cleanrooms and Associated Controlled Environments, May 1, 1999

CCSDS 701.0-B-3: Recommendations for Advanced Orbiting Systems, Networks and Data Links, Architectural Specification

IEEE/ASTM SI-10: American National Standard for Use of the International System of Units (SI): The Modern Metric System, December 2002

CCSDS 102.0-B-5 Packet Telemetry. Blue Book, Issue 5, November 2000

CCSDS 103.0-B-2 Packet Telemetry Service Specification. Blue Book. Issue 2, June 2001

417-R-RPT-0027: The Radiation Environment for Electronic Devices on GOES-R Series Satellites, March 2004

CCSDS 301.0-B-3: Time Code Formats. Blue Book. Issue 3, January 2002

NASA/TM-2001-211221: Guideline for the Selection of Near-Earth Thermal Environment Parameters for Spacecraft Design, October 2001

417-R-RPT-0050 GOES-R SpaceWire Transport Protocol

2.2 Reference Documents

- 2.2-1 Spacecraft Attitude Determination and Control, edited by James R. Wertz (Boston: Reidel, 1978), pp. 268-270.

Farrenkopf, R. L., "Analytic Steady-State Accuracy Solutions for Two Common Spacecraft Attitude Estimators," Journal of Guidance and Control (Reston, VA: American Institute of Aeronautics and Astronautics), July-August, 1978, Vol. 1, No. 4, pp. 282-284.

Markley, F. Landis, and R. G. Reynolds, "Analytic Steady-State Accuracy of a Spacecraft Attitude Estimator," Journal of Guidance, Control, and Dynamics (Reston, VA: American Institute of Aeronautics and Astronautics), November-December, 2000, Vol. 23, No.6, pp. 1065-1067.

3 Requirements

3.1 General Requirements

3.1.1 Instrument Modes

3.1.1.1 Mode Changes External Harm

- GIRD19 3.1.1.1-1 The instrument **shall** transition from its current mode to any other mode without harming any other instrument or spacecraft bus component.

3.1.1.2 Power Off Mode

- GIRD21 3.1.1.2-1 The Instrument Power OFF Mode **shall** not draw operational power.

3.1.1.3 Instrument Safe Mode

3.1.1.3.1 Instrument Safe Mode Command

- GIRD29 3.1.1.3.1-1 The instrument **shall** enter Instrument Safe Mode upon receipt of a safeing command from the spacecraft.

3.1.1.3.2 Instrument Safe Mode Timeout

- GIRD31 3.1.1.3.2-1 The instrument **shall** enter Instrument Safe Mode upon the detection of 10 consecutive missing time messages.

3.1.1.4 Survival and Storage Modes

- GIRD35 3.1.1.4-1 The spacecraft **shall** provide survival heater power in Survival and Storage modes.

	3.1.1.4-2	The instrument shall not draw operational power while in Survival and Storage modes.
	3.1.2	Operational Concepts
	3.1.2.1	Pre-Launch
	3.1.2.1-1	The satellite will be transported to the launch site where final vehicle preparations and checkout will be accomplished.
	3.1.2.1-2	Final inter-segment and system verification tests will be accomplished prior to launch.
	3.1.2.1-3	Instrument testing and inspection to be accomplished at the launch site will be documented in the ICD.
	3.1.2.2	Launch and Orbit Raising
	3.1.2.2-1	During launch the various spacecraft subsystems may be powered on or turned off in order to provide protection from the launch and injection environments or to comply with other specified requirements. Spacecraft telemetry to monitor vehicle status may be provided during launch. Transmission of launch vehicle telemetry may satisfy this requirement during the launch phase. During the Orbit Raising and after insertion into its operational orbit, appropriate deployments would be initiated by command. Spacecraft telemetry transmission to ground monitoring stations would be used to the extent practicable.
	3.1.2.2-2	The instrument will be in Survival Mode during launch.
	3.1.2.2-3	The instrument contractor will identify in the IDD the required configuration of the instrument for the launch environment, and the power required, in the event the mode is to be anything other than OFF, and also to document required sequences leading up to the pre-launch OFF mode.
	3.1.2.3	On-Orbit Concept
	3.1.2.3-1	The satellite will operate in a geosynchronous orbit (Semi-major axis of approximately 42,164 Km) located at either 75° or 135° west longitude. Normal on-orbit operations entail periodic station keeping maneuvers that keep the satellite within a 0.5° inclination about the equator and within $\pm 0.5^\circ$ of the on-station longitude.
	3.1.2.3-2	The spacecraft will be 3-axis stabilized.
GIRD842	3.1.2.3-3	Instruments shall survive an anomaly resulting in a static instrument line-of-sight (LOS) such that the sun passes through the LOS at orbit rate.
GIRD45	3.1.2.3-4	Instruments shall survive a spacecraft attitude anomaly resulting in the sun being at an arbitrary fixed location within the instrument field of regard (FOR).
GIRD46	3.1.2.3-5	Instruments shall survive a spacecraft attitude anomaly resulting in the sun sweeping through the field-of-view (FOV) of the instrument radiator from “horizon to horizon” at a rate of 6°/minute, passing through radiator normal.

		3.1.3 Dimension Standard
GIRD48	3.1.3-1	For all documents related to instrument interfaces, the spacecraft and instrument contractors shall use the International System of Units (SI) for all measurement units in accordance with <u>IEEE/ASTM SI-10</u> . The contractor may include English units in parenthesis for clarification.
		3.1.4 Coordinates
GIRD52	3.1.4-1	The orbit reference frame (ORF) shall be defined as follows: <i>(CCR 00005)</i> The ORF is orthogonal and right-handed. The ORF origin is at the spacecraft center of mass. The ORF +z axis points toward the center of the Earth. The ORF +y axis points along the negative orbit normal. The ORF +x axis completes the triad.
GIRD53	3.1.4-2	The body reference frame (BRF) shall be defined as follows: <i>(CCR 00005)</i> The BRF is orthogonal and right-handed. The BRF is fixed to the body of the spacecraft. The location of the BRF origin will be specified by the spacecraft contractor. The BRF axes are nominally parallel to the ORF axes when spacecraft attitude is in its nominal Earth-pointing, upright yaw attitude with zero attitude error. The roll, pitch, and yaw axes are defined to be parallel to the BRF x, y, and z axes, respectively.
	3.1.4-3	If there is a yaw-flip, the spacecraft will be flown upright (+Y BRF pointed in the +Y ORF direction) during northern hemisphere winter and inverted (+Y BRF pointed in the -Y ORF direction) during northern hemisphere summer. i.e., the +Y BRF axis is generally in the same hemisphere as the Sun.
	3.1.4-4	If there is no yaw-flip, the spacecraft will be flown upright all year.
	3.1.4-5	At the option of the government, the spacecraft may be flown such that the BRF is offset from the ORF so that the BRF x-axis is always parallel to the Earth's equator and/or the BRF z-axis always points to the nominal subsatellite point.
GIRD870	3.1.4-6	The reference coordinate system of each instrument unit shall be nominally parallel to the spacecraft BRF coordinate system, with the exception of solar-pointing instruments.
GIRD871	3.1.4-7	The origin of the coordinate system of each instrument unit shall be located and defined inside the mechanical envelope of the instrument unit.
		3.1.5 Yaw Flip
GIRD1136	3.1.5-1	For an instrument with passive cryogenic detector cooling, the GOES spacecraft will be rotated 180° about the Z-axis (yaw) twice per year to keep the -Y axis side of the spacecraft shaded, within ±4 days of the Sun crossing

		the orbit plane.
GIRD1137	3.1.5-2	The rotation will be performed any time during the 8-day window and will be carried out such that neither the Sun nor Earth illuminates the cooler during the maneuver. The maneuver is expected to last less than 1 hour. The net effect reverses the sign of the roll and pitch axes while maintaining yaw pointing at nadir.
		3.2 Interface Requirements
GIRD931	3.2-1	All instrument-to-spacecraft interfaces shall be single fault tolerant.
		3.2.1 Mechanical
		3.2.1.1 Instrument Envelopes
GIRD59	3.2.1.1-1	The instrument units shall meet the dimensional envelope constraints defined in the UIID under conditions encountered during launch, deployment, and on-orbit operations.
		3.2.1.1.1 Envelope Documentation
	3.2.1.1.1-1	The instrument contractor will document the instrument unit envelopes in the IDD by engineering drawings with a set of “not to exceed” dimensions. The instrument envelopes will be inclusive of the thermal blankets.
	3.2.1.1.1-2	The instrument contractor will ensure that the swept or deployed volume includes tolerances, distortions and misalignments.
		3.2.1.1.2 Critical Clearances
GIRD65	3.2.1.1.2-1	The satellite shall fit within the dynamic envelope of the launch vehicle fairing as described in the satellite-to-launch vehicle ICD.
	3.2.1.1.2-2	The spacecraft contractor will position the instrument units on the spacecraft to ensure that the stowed, deploying, and final deployed positions of the instrument units clear all obstacles including obstacles on the spacecraft, other instruments, and the launch vehicle.
GIRD67	3.2.1.1.2-3	A minimum of 2.5 cm clearance shall be maintained between the instrument units and surrounding structure.
	3.2.1.1.2-4	The spacecraft contractor will implement a critical clearance analysis to ensure that the clearance rule is not violated.
GIRD69	3.2.1.1.2-5	The instrument thermal blankets shall not impede any deployment or mechanism motion.
		3.2.1.2 Fields of View
GIRD73	3.2.1.2-1	The spacecraft shall provide the instrument fields-of-view defined in the UIID.
	3.2.1.2-2	The instrument contractor will document the instrument field-of-view requirements in the IDD.
GIRD77	3.2.1.2-3	Instruments shall meet all performance requirements whether or not the

spacecraft performs a yaw flip, except for instruments with cryogenic detectors cooled by a passive radiator.

3.2.1.3 Mass Properties

- | | | |
|--------|-----------|---|
| GIRD79 | 3.2.1.3-1 | The instrument mass shall be less than or equal to that allocated in the UIID. |
| | 3.2.1.3-2 | The mass of the instrument units will be measured with an accuracy of ± 0.5 kg. |
| GIRD81 | 3.2.1.3-3 | The instrument mass shall be constant unless mass expulsion rates and substances are allocated by the UIID. |
| | 3.2.1.3-4 | The nominal launch mass with tolerances of each instrument unit will be provided to the spacecraft contractor for documentation in the ICD. |

3.2.1.3.1 Center of Mass

- | | |
|-------------|---|
| 3.2.1.3.1-1 | The instrument contractor will determine the centers of mass for each flight instrument unit relative to the instrument unit coordinate system with an accuracy of ± 5 mm including launch and deployed configurations. |
| 3.2.1.3.1-2 | The launch and deployed centers of mass with tolerances of each instrument unit will be provided to the spacecraft contractor for documentation in the ICD, referenced to the instrument coordinate axes. |

3.2.1.3.2 Inertia Properties

- | | |
|-------------|---|
| 3.2.1.3.2-1 | The instrument unit moment of inertia will be defined using the instrument unit coordinate frame passing through the instrument center of mass. |
| 3.2.1.3.2-2 | The instrument contractor will determine the moments and products of inertia values with an accuracy of $\pm 5\%$ of the maximum principal moment of inertia. |
| 3.2.1.3.2-3 | The launch and deployed moments and products of inertia with tolerances of each separately-mounted instrument unit, referenced to the instrument coordinate axes, will be provided to the spacecraft contractor for documentation in the ICD. |

3.2.1.4 Mounting

3.2.1.4.1 Hardware

- | | | |
|---------|-------------|--|
| GIRD100 | 3.2.1.4.1-1 | The spacecraft contractor will define and document all mounting hardware in the ICD and indicate the hardware provider. |
| | 3.2.1.4.1-2 | Unless otherwise specified, the spacecraft contractor will provide all mounting hardware for the instrument units. |
| | 3.2.1.4.1-3 | The instrument sensor unit shall mount to the spacecraft as described in the instrument UIID. |
| | 3.2.1.4.1-4 | The instrument contractor will provide all kinematic mounts, plus vibration isolation and thermal isolation mounting hardware. |
| | 3.2.1.4.1-5 | The instrument units will be delivered to the spacecraft contractor with flight mounts installed. |

		3.2.1.4.2 Method
GIRD104	3.2.1.4.2-1	The mounting method shall accommodate manufacturing tolerances, structural distortion, thermal distortions and alignment requirements.
GIRD105	3.2.1.4.2-2	The instrument units, excluding the sensor unit shall be capable of being mounted to the spacecraft with the spacecraft mounting surface in the vertical or in the horizontal position with the spacecraft mounting surface normal pointing up.
GIRD1070	3.2.1.4.2-3	The instrument sensor unit shall be capable of being mounted to the spacecraft with the spacecraft mounting surface in the horizontal position with the spacecraft mounting surface normal pointing up.
GIRD106	3.2.1.4.2-4	For instrument units with a mass greater than 15 kg, a minimum of three lifting points shall be provided.
GIRD107	3.2.1.4.2-5	The design of the lifting points shall allow handling with an overhead crane including when the unit is in its flight configuration.
GIRD1056	3.2.1.4.2-6	Each instrument unit design shall allow integration and de-integration to the spacecraft while using access constrained to the inside of the instrument dimensional envelope defined in the UIID with access penetrations into this envelope through the face of the envelope that is opposite to the mechanical interface plane.
GIRD109	3.2.1.4.2-7	Each instrument unit mounting method shall not require access from inside the spacecraft.
	3.2.1.4.2-8	The method by which each instrument unit is mounted to the spacecraft will be defined in the ICD.
		3.2.1.4.3 Handling Fixtures
	3.2.1.4.3-1	The instrument contractor will provide proof tested handling fixtures for each unit with a mass greater than 15 kg.
GIRD113	3.2.1.4.3-2	Handling fixtures shall be designed to 5 times limit load for ultimate and 3 times limit load for yield.
	3.2.1.4.3-3	Handling fixtures will be tested to 2 times working load.
		3.2.1.4.4 Interface
GIRD116	3.2.1.4.4-1	The spacecraft mounting surface shall be flat to less than 0.83 mm per meter peak to peak.
	3.2.1.4.4-2	The spacecraft contractor working with the instrument contractor will define the mechanical mounting interface requirements for each instrument unit in the ICD. Requirements include surface flatness, finish, mounting bolt size, number, material, and torque limits.
		3.2.1.4.5 Location
	3.2.1.4.5-1	The spacecraft contractor working with the instrument contractor will define and document the location and orientation of instrument units on the spacecraft in the ICD.

	3.2.1.4.5-2	Coordinates and dimensions of the holes for mounting hardware will be specified at the mechanical interface and defined in the ICD.
	3.2.1.4.6	Drill Templates
GIRD122	3.2.1.4.6-1	The pattern of mounting holes in a unit shall allow like units to be interchanged.
GIRD123	3.2.1.4.6-2	Instrument unit, spacecraft, and test fixture interfaces shall be drilled using templates to correctly establish the pattern of the mounting holes.
GIRD124	3.2.1.4.6-3	The drill template shall include appropriate alignment, orientation and location reference information and alignment cubes if required.
	3.2.1.4.6-4	The spacecraft contractor will document fabrication, functional requirements, and orientation information for the drill templates in the ICD.
	3.2.1.4.6-5	The instrument contractor will provide an alignment drill template labeled with appropriate alignment, orientation, location reference information, and alignment cubes if necessary.
	3.2.1.5	Alignment
	3.2.1.5-1	The instrument contractor will measure the alignment between the sensor line-of-sight and the instrument alignment reference frame and deliver the results to the spacecraft contractor.
	3.2.1.5-2	The spacecraft contractor is responsible for the alignment knowledge of the input axes of the spacecraft IRU with respect to the IRU reference frame.
	3.2.1.5-3	The spacecraft contractor will document all alignment measurements in an alignment report.
	3.2.1.5-4	The spacecraft and instrument contractors will negotiate and document in the ICD any relevant alignment requirements not specified in this document (GIRD).
	3.2.1.5.1	Nadir and Body-Mounted Instrument Alignment
	3.2.1.5.1.1	References
GIRD 129	3.2.1.5.1.1-1	The instrument shall include a permanent alignment reference on the instrument sensor unit composed of a minimum 2.54 cm alignment cube and a mounting surface datum. The instrument alignment cube defines the instrument alignment reference frame.
GIRD 131	3.2.1.5.1.1-2	The spacecraft inertial reference unit (IRU) shall include an alignment cube mounted on the IRU. This alignment cube defines the IRU reference frame. The IRU reference frame is the navigation reference frame of the spacecraft and is nominally parallel to the BRF.
GIRD132	3.2.1.5.1.1-3	The spacecraft IRU and instrument alignment cube pairs shall be viewable from two orthogonal directions.
	3.2.1.5.1.1-4	The instrument contractor will document the location of all instrument optical alignment cubes in the IDD.
	3.2.1.5.1.1-5	The instrument mounting frame is an orthogonal reference frame defined by

the locations of the spacecraft side of the instrument mounting points. A rigorous definition of this frame will be documented in the ICD. The instrument mounting frame is nominally parallel to the BRF.

3.2.1.5.1.2 Responsibilities

- 3.2.1.5.1.2.-1 The spacecraft contractor will align the instrument alignment reference frame to the spacecraft IRU reference frame.
- 3.2.1.5.1.2.-2 The spacecraft contractor will measure the alignment between the instrument alignment reference frame and the spacecraft IRU reference frame.

3.2.1.5.1.3 Placement

- GIRD140 3.2.1.5.1.3.-1 The placement of the instrument alignment reference frame with respect to the spacecraft IRU reference frame **shall** be to within 0.25 degrees per axis (TBR), including variation over all launch and on-orbit environments

3.2.1.5.1.4 Initial Alignment Knowledge

- GIRD142 3.2.1.5.1.4.-1 The prelaunch alignment knowledge of the instrument alignment reference frame with respect to the spacecraft IRU input axes **shall** be 50 (TBR) microradians or better per axis.

3.2.1.5.1.5 On-Orbit Alignment Knowledge

- GIRD1088 3.2.1.5.1.5.-1 The on-orbit alignment knowledge of the instrument mounting frame with respect to the spacecraft IRU input axes **shall** be 50 (TBR) microradians or better, per axis. This requirement includes launch shift, on-orbit calibration uncertainty, on-orbit environments, and spacecraft structural and thermal stability.
- GIRD1089 3.2.1.5.1.5.-2 Contractor-specified operations for on-orbit calibration **shall** be consistent with the GOES-R operational concept, particularly as related to operational outages, as documented in **TBS**.

3.2.1.5.1.6 Alignment Rate of Change

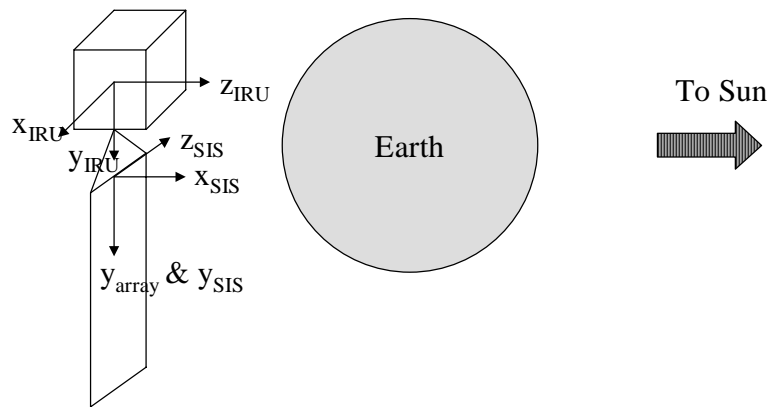
- GIRD144 3.2.1.5.1.6.-1 The rate of change of the alignment of the instrument mounting frame with respect to the spacecraft IRU input axes **shall** not exceed 100 (TBR) microradians per hour per axis. This requirement includes on-orbit environments and spacecraft structural and thermal stability.

3.2.1.5.2 Solar Imaging Suite (SIS) Alignment

3.2.1.5.2.1 References

- GIRD 1093 3.2.1.5.2.1-1 The SIS **shall** include a permanent alignment reference on the SIS unit composed of a minimum 2.54 cm alignment cube and a mounting surface datum. The SIS alignment cube defines the SIS alignment reference frame.
- GIRD1094 3.2.1.5.2.1-2 The spacecraft Sun-Pointing Platform (SPP) **shall** include an alignment cube

- mounted on the SPP. This alignment cube defines the SPP reference frame. The SPP Coordinate Frame (SCF) is right-handed and is nominally parallel to this alignment cube. The X-axis of SCF nominally points to the center of the Sun. The elevation degree of freedom for the SCF to point to the Sun is provided by articulating the SPP about the Z-axis of the SCF. The Y-axis of the SCF completes the right-handed triad.
- GIRD1095 3.2.1.5.2.1-3 The SPP and SIS alignment cube pairs **shall** be viewable from two orthogonal directions during the integration of the SIS Mounting Panel with the Sun-Pointing Platform.
- 3.2.1.5.2.1-4 The SIS contractor will document the locations of all instrument optical alignment cubes in the IDD.
- 3.2.1.5.2.1-5 The SIS reference coordinate system is defined as follows: The SIS X-axis is the boresight and is normal to the SIS YZ-plane. The SIS YZ-plane nominally contains the detector focal plane and the SIS Z-axis is nominally parallel to the SPP articulation axis.
- 3.2.1.5.2.2 Responsibilities
- 3.2.1.5.2.2-1 The spacecraft contractor will align the SIS Mounting Panel alignment reference frame to the spacecraft Sun-Pointing Platform reference frame.
- 3.2.1.5.2.2-2 The spacecraft contractor will conduct analyses required to allocate the flow-down budget for the alignment between the SIS Mounting Panel and the SPP.
- 3.2.1.5.2.2-3 The spacecraft contractor will measure the alignment between the SIS alignment reference frame and the spacecraft SPP reference frame.
- 3.2.1.5.2.2-4 The spacecraft contractor is responsible for the alignment knowledge of the SIS with respect to the IRU reference frame.
- 3.2.1.5.2.3 Placement
- GIRD1104 3.2.1.5.2.3-1 The configuration of the spacecraft and SIS at the spacecraft local midnight at equinox (See Figure Below) is defined when the SIS YZ plane is parallel with the IRU XY-plane, the placement of both the SIS Y- and Z-axes **shall** be within 0.3° of the IRU Y- and X-axes, respectively, including variation over all launch and on-orbit environments.



Spacecraft & SIS Configuration at local midnight at equinox

GIRD1106	3.2.1.5.2.4-1	<p>3.2.1.5.2.4 Initial Alignment Knowledge</p> <p>The prelaunch alignment knowledge of the Sun-Pointing Platform alignment reference frame with respect to the spacecraft IRU input axes shall be TBD microradians or better, per axis.</p>
GIRD 1108	3.2.1.5.2.5-1	<p>3.2.1.5.2.5 Alignment Rate of Change</p> <p>The rate of change of the alignment of the Sun-Pointing Platform alignment reference frame with respect to the spacecraft IRU input axes shall not exceed TBD microradians per hour per axis. This requirement includes on-orbit environments and spacecraft structural and thermal stability.</p>
GIRD146	3.2.1.6-1	<p>3.2.1.6 Access</p> <p>The position of the instrument units on the spacecraft shall leave adequate clearance between the instrument and surrounding structures to provide access to instrument mounting hardware, access to instrument connectors, and space for instrument interfacing harness service loops.</p>
GIRD148	3.2.1.6-2	Instrument access requirements will be documented in the ICD.
GIRD148	3.2.1.6-3	All instrument units to be installed, removed or replaced at the satellite level shall be accessible without disassembly of the unit.
	3.2.1.7-1	<p>3.2.1.7 Attitude and Disturbances for Nadir and Body-Mounted Instruments</p> <p>The requirements in this section apply to nadir-pointing instruments while the instrument is on orbit and operating and also to body-mounted space environment instruments.</p>

		3.2.1.7.1 Spacecraft Attitude and Disturbances
GIRD1109	3.2.1.7.1-1	The interface attitude error and disturbance limits include government-held reserve and all spacecraft errors, including orbit and attitude knowledge, attitude command error, and attitude control error with all instruments operating in normal operational mode.
		3.2.1.7.1.1 Attitude Error
GIRD153	3.2.1.7.1.1-1	The attitude error of the instrument mounting frame relative to the desired ORF-referenced attitude shall not exceed ± 360 (TBR) microradians, 3-sigma, per axis. Attitude error is defined as the difference between the desired attitude and the actual, or true, attitude of the instrument mounting frame.
GIRD1067	3.2.1.7.1.1-2	The instrument mounting frame attitude shall be stable to within 500 microradians, peak-to-peak, 3-sigma, per axis, over any 60-second period of time.
		3.2.1.7.1.2 Attitude Error Rate
GIRD155	3.2.1.7.1.2-1	The instrument mounting frame attitude error rate relative to the desired ORF-referenced attitude shall not exceed ± 100 microradians per second, 3-sigma, per axis, when the rate is filtered by a fourth order Butterworth low pass filter with a -3dB frequency of 15 Hz.
		3.2.1.7.1.3 Spacecraft Translation Acceleration Limits
GIRD157	3.2.1.7.1.3-1	The translational accelerations at the spacecraft side of each instrument sensor unit mount shall not exceed the limits specified in the Translational Acceleration Limits for Spacecraft to Instrument Table below. The limits apply to each orthogonal axis after the acceleration is bandpass-filtered using at least a fourth-order band-pass Butterworth filter with -3dB frequencies of f_1 and f_2 . (Note that the filter has fourth-order rolloff on both sides of the response.) The accelerations can be present at any combination of the instrument sensor unit mounts and along any combination of the three orthogonal axes at each mount.
		Translational Acceleration Limits for Spacecraft to Instrument Table

f_1 (Hz)	f_2 (Hz)	Peak Limit (mg)	f_1 (Hz)	f_2 (Hz)	Peak Limit (mg)	f_1 (Hz)	f_2 (Hz)	Peak Limit (mg)
0.0	512.0	15.0	26.9	30.2	0.4	114.0	128.0	1.4
0.9	10.1	1.5	28.5	32.0	0.4	120.8	135.6	1.4
6.3	32.0	1.0	30.2	33.9	1.4	128.0	143.7	1.4
20.2	101.6	3.0	32.0	35.9	1.4	135.6	152.2	1.4
64.0	322.5	7.0	33.9	38.1	1.4	143.7	161.3	1.4
203.2	512.0	14.0	35.9	40.3	1.4	152.2	170.9	1.4
9.0	10.1	0.4	38.1	42.7	1.4	161.3	181.0	1.4
9.5	10.7	0.4	40.3	45.3	1.4	170.9	191.8	1.4
10.1	11.3	0.4	42.7	47.9	1.4	181.0	203.2	1.4
10.7	12.0	0.4	45.3	50.8	1.4	191.8	215.3	1.4
11.3	12.7	0.4	47.9	53.8	1.4	203.2	228.1	1.4
12.0	13.5	0.4	50.8	57.0	1.4	215.3	241.6	1.4
12.7	14.3	0.4	53.8	60.4	1.4	228.1	256.0	1.4
13.5	15.1	0.4	57.0	64.0	1.4	241.6	271.2	1.4
14.3	16.0	0.4	60.4	67.8	1.4	256.0	287.4	1.4
15.1	17.0	0.4	64.0	71.8	1.4	271.2	304.4	1.4
16.0	18.0	0.4	67.8	76.1	1.4	287.4	322.5	1.4
17.0	19.0	0.4	71.8	80.6	1.4	304.4	341.7	1.4
18.0	20.2	0.4	76.1	85.4	1.4	322.5	362.0	1.4
19.0	21.4	0.4	80.6	90.5	1.4	341.7	383.6	1.4
20.2	22.6	0.4	85.4	95.9	1.4	362.0	406.4	1.4
21.4	24.0	0.4	90.5	101.6	1.4	383.6	430.5	1.4
22.6	25.4	0.4	95.9	107.6	1.4	406.4	456.1	1.4
24.0	26.9	0.4	101.6	114.0	1.4	430.5	483.3	1.4
25.4	28.5	0.4	107.6	120.8	1.4	456.1	512.0	1.4

GIRD1110 3.2.1.7.1.3-2 The translational accelerations at the spacecraft side of each instrument sensor unit mount **shall** produce an absolute peak acceleration Shock Response Spectra (SRS) less than the limits set in the On Orbit Operational SRS Acceleration Limits Table below. The limits apply to each orthogonal axis for SRS natural frequencies greater than or equal to f_1 and less than f_2 when using a quality factor, Q , of 50. The SRS is computed after the acceleration is high pass filtered with a fourth order Butterworth filter with a -3dB cut off at 1.0 Hz.

On Orbit Operational SRS Acceleration Limits Table

f_1 (Hz)	f_2 (Hz)	SRS Limit (mg)
10	30	10.0
30	90	30.0
90	300	45.0

3.2.1.7.2 Instrument-to-Spacecraft Disturbances

3.2.1.7.2.1 Instrument Disturbance Torque Limits

- GIRD160 3.2.1.7.2.1-1 At any time during the operational mode of the spacecraft, the sum of the magnitude of the instrument sensor unit's uncompensated torques and the magnitude of its uncompensated linear forces multiplied by a lever arm of 2 meters **shall** not exceed 1.0 N-m.

3.2.1.7.2.2 Instrument Allowable Angular Momentum

- GIRD162 3.2.1.7.2.2-1 The magnitude of the instrument unit's uncompensated angular momentum **shall** not exceed 1.0 N-m-sec.
- 3.2.1.7.2.2-2 The instrument contractor will document the angular momentum produced by the instrument in the IDD.

3.2.1.7.2.3 Instrument Disturbances Allocation

- GIRD165 3.2.1.7.2.3-1 The instrument **shall** not exceed disturbances defined in the UIID given a spacecraft characterized by Laplace domain transfer functions $H_{\theta T}(s)$, $sH_{\theta T}(s)$ and $as^2H_{\theta T}(s)$ with the parameters in the tables named Parameters for Roll Torques and Rotations about the X Axis, Parameters for Pitch Torques and Rotations about the Y Axis, and Parameters for Yaw Torques and Rotations about the Z Axis.

Filtering the instrument sensor unit torque time history in Newton-meter units with $H_{\theta T}(s)$ estimates the spacecraft pointing error displacement in radian units. Filtering with $sH_{\theta T}(s)$ estimates the spacecraft pointing error rate in radians per second units. Filtering with $as^2H_{\theta T}(s)$ estimates the spacecraft linear acceleration at a mount in meters per second per second units. When filtering roll axis torques with $H_{\theta T}(s)$, $sH_{\theta T}(s)$ and $as^2H_{\theta T}(s)$, use table Parameters for Roll Torques and Rotations about the X Axis. When filtering pitch, use table Parameters for Pitch Torques and Rotations about the Y Axis. When filtering yaw, use table Parameters for Yaw

Torques and Rotations about the Z Axis. Transfer function $H_{\theta T}(s)$ is plotted in Figure Torque to Spacecraft Pointing Error Transfer Functions for roll, pitch and yaw.

Torque to Angular Displacement Transfer Function

$$\frac{\theta(s)}{T(s)} = H_{\theta T}(s)$$

Torque to Angular Rate Transfer Function

$$\frac{\dot{\theta}(s)}{T(s)} = sH_{\theta T}(s)$$

Torque to Translational Acceleration Transfer Function

$$\frac{\ddot{x}(s)}{T(s)} = as^2 H_{\theta T}(s)$$

where

$$H_{\theta T}(s) = \sum_{i=1}^n \frac{1/J_i}{s^2 + 2\zeta_i \omega_i s + \omega_i^2} \quad \text{and} \quad \omega_i = 2\pi f_i.$$

Parameters for Roll Torques and Rotations about the X Axis

a (m)	n	i	f_i (Hz)	ζ_i (%)	J_i (kg-m ²)
1.5	12	1	0.01	30.0	4721
		2	0.40	2.0	10733
		3	1.34	0.1	59081
		4	1.92	0.1	34514
		5	13.24	0.1	972
		6	16.54	0.1	732
		7	23.56	0.1	3468
		8	30.55	0.1	5017
		9	30.91	0.1	2975
		10	31.00	0.1	1313
		11	31.17	0.1	1204
		12	39.36	0.1	25821

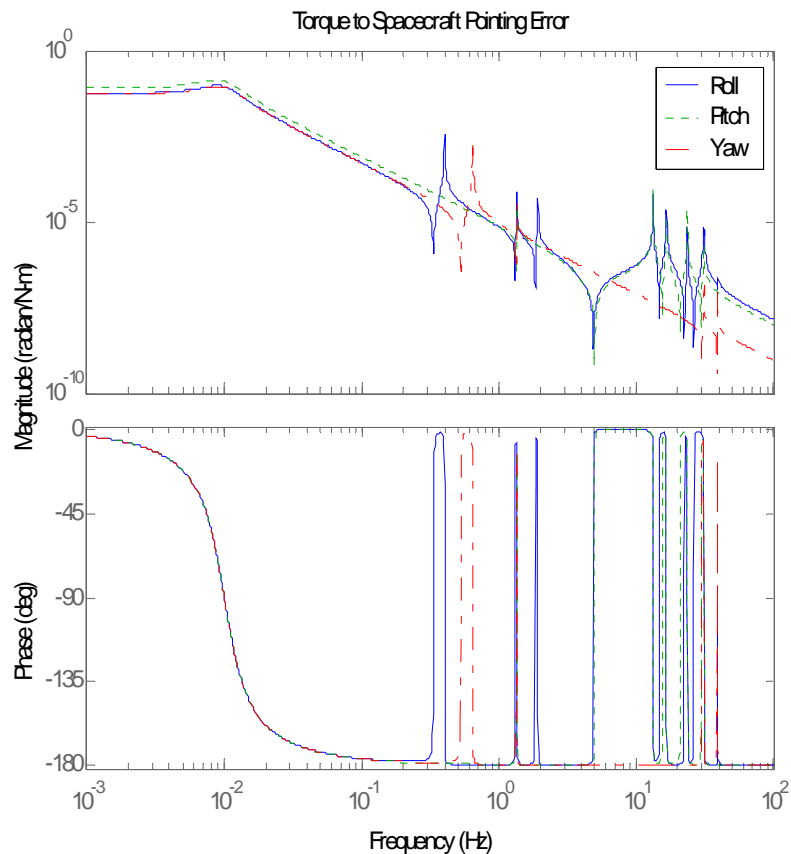
Parameters for Pitch Torques and Rotations about the Y Axis

a (m)	n	i	f_i (Hz)	ζ_i (%)	J_i (kg-m ²)
1.5	9	1	0.01	30.0	3203
		2	1.35	0.1	89061
		3	13.24	0.1	820
		4	16.54	0.1	1620
		5	23.56	0.1	985
		6	30.55	0.1	55722
		7	30.91	0.1	8377
		8	31.00	0.1	3897
		9	31.17	0.1	6104

Parameters for Yaw Torques and Rotations about the Z Axis

a (m)	n	i	f_i (Hz)	ζ_i (%)	J_i (kg-m ²)
1.5	5	1	0.01	30.0	4873
		2	0.64	2.0	10001
		3	1.35	0.1	76471
		4	31.00	0.1	45578
		5	39.36	0.1	73013

Torque to Spacecraft Pointing Error Transfer Functions



3.2.1.8 Attitude Errors and Disturbances for SIS

GIRD1112 3.2.1.8-1

The requirements in this section apply to SIS, located on the Sun-Pointing Platform (SPP) while all the instruments and mechanisms on-board the spacecraft in-orbit are operating. The Sun-Pointing Platform interface Sun-pointing error and disturbance limits include government-held reserve and all spacecraft errors, including orbit and attitude knowledge, attitude command error, and attitude control error with all instruments operating in normal operational mode.

3.2.1.8-2

The North-South and East-West directions correspond to the elevation and azimuth directions, respectively, of the center of the Sun when viewed from the Sun-Pointing Platform.

3.2.1.8.1 Spacecraft-to-Instrument Disturbances

		3.2.1.8.1.1 Sun-Pointing Platform Attitude Error and Stability
GIRD1116	3.2.1.8.1.1-1	Using the Sun-pointing error data provided by the SIS, the spacecraft shall point the SIS to the Sun to within ± 2.3 arcminutes (3-sigma, per axis) of the Sun center.
GIRD1138	3.2.1.8.1.1-2	If the Sun-pointing error data from the SIS is not available, the spacecraft shall point the line-of-sight to the Sun in the SIS Mounting Panel Coordinate Frame to within ± 1.5 arc-minutes (TBR), 3-sigma, per axis, of the Sun center.
GIRD1117	3.2.1.8.1.1-3	The Sun-pointing attitude error of the Sun-Pointing Platform shall be stable to within 18 arc-seconds (TBR), 3-sigma, per axis, peak-to-peak, over the 20-second SIS exposure period of time, for each of the North-South and East-West axes, excluding the blackbody calibration durations of the nadir-pointing instruments.
GIRD1118	3.2.1.8.1.1-4	In addition, the Sun-pointing in the North-South or East-West direction shall be stable to within 100 arc-seconds (TBR), 3 sigma, per axis, peak-to-peak, over 60-seconds, with no exclusions.
		3.2.1.8.1.2 Sun-Pointing Attitude Error Rate
GIRD1120	3.2.1.8.1.2-1	The Sun-Pointing Platform attitude error rate shall not exceed ± 100 microradians per second, 3-sigma, per axis, when the rate is filtered by a fourth-order Butterworth low pass filter with a -3dB frequency of 15 Hz.
		3.2.1.8.1.3 Sun-pointing Attitude Knowledge
GIRD1122	3.2.1.8.1.3-1	The spacecraft-provided knowledge of the Sun-pointing error of the Sun-Pointing Platform shall not exceed 10 arc-seconds (TBR).
		3.2.1.8.1.4 East-West and North-South Bias-pointing
GIRD1124	3.2.1.8.1.4-1	The spacecraft shall provide a ground-commandable bias-pointing capability for the SPP in each of the East-West and North-South directions.
GIRD1125	3.2.1.8.1.4-2	The bias range shall be at least ± 40 arc-minutes about the Sun line, in one arc-minute or smaller increments.
GIRD1126	3.2.1.8.1.4-3	The East-West and North-South bias pointing accuracy requirements shall be the same for the non-bias pointing in Section titled Sun-Pointing Platform Attitude Error and Stability.
		3.2.1.8.2 Instrument-to-Spacecraft Disturbances
		3.2.1.8.2.1 Instrument Disturbance Torque Limits
GIRD1129	3.2.1.8.2.1-1	At any time during the operational mode of the spacecraft, the sum of the magnitude of the instrument sensor unit's uncompensated torques and the magnitude of its uncompensated linear forces multiplied by a lever arm of 2 meters shall not exceed 0.2 (TBR) N-m.
GIRD1130	3.2.1.8.2.1-2	The instrument's uncompensated torque vs. time characteristic shall be

shaped so as to minimize the excitation of the flexible modes of vibration of the spacecraft.

3.2.1.8.2.2 Instrument Allowable Angular Momentum

- GIRD1132 3.2.1.8.2.2-1 The magnitude of the instrument unit's uncompensated angular momentum **shall** not exceed 0.1 (TBR) N-m-sec.
- 3.2.1.8.2.2-2 The instrument contractor will document the angular momentum produced by the instrument in the IDD.

3.2.1.9 Flight and Non-Flight Equipment

- 3.2.1.9-1 The instrument contractor will provide information on all items to be installed or removed prior to flight for identification in the IDD.
- 3.2.1.9-2 The instrument contractor will tag all non-flight items to be removed prior to flight with a red tag stating, "**Remove Before Flight**".
- 3.2.1.9-3 The instrument contractor will tag all flight items to be installed prior to flight with a green tag stating, "**Install Before Flight**".

3.2.2 Thermal

3.2.2.1 Thermal Control Concept

- 3.2.2.1-1 The instrument units installed on the spacecraft bus fall under one of the following categories:

- a) Thermally-independent units are conductively and radiatively decoupled from the spacecraft and reject their heat directly to space.
- b) Thermally-coupled units dissipate their heat to the spacecraft.
- c) Solar Pointing instruments are special thermally isolated case, where the SIS mounting plate is isolated from the spacecraft solar array yoke and tilt motor and actuator.

In general:

- Instrument electronic units are thermally-coupled.
- Instrument sensor units are thermally-independent.

The instrument contractor will document the thermal control concept in the IDD.

- GIRD844 3.2.2.1-2 The spacecraft **shall** maintain the instrument units mounting surface temperature within instrument Mission Allowable Temperatures (MAT) during instrument operation.

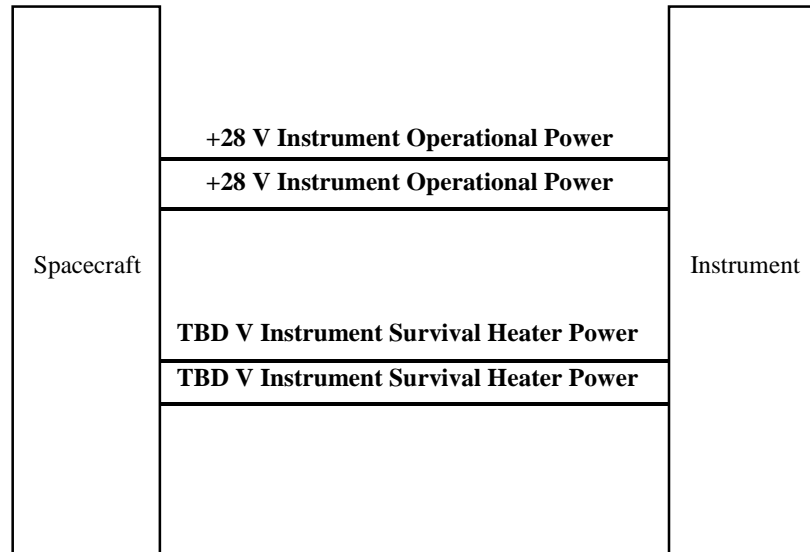
- GIRD845 3.2.2.1-3 The spacecraft **shall** maintain the instrument units mounting surface temperature within non-operational limits when the instrument is non-operating.

3.2.2.1.1 Independent Thermal Control Design

GIRD1141	3.2.2.1.1-1	The instrument contractor is responsible for independent thermal unit thermal design.
	3.2.2.1.1-2	Thermally-independent instrument units shall restrict heater power consumption within overall power limitations.
		3.2.2.1.2 Coupled Thermal Control Design
	3.2.2.1.2-1	The instrument contractor is responsible for thermally coupled unit internal thermal design. For coupled units, the instrument contractor will provide unit internal design information including internal dissipation, couplings, and interface heat flow so the spacecraft contractor can appropriately interface with the unit.
		3.2.2.2 Heat Transfer
	3.2.2.2-1	The net heat transfer (conducted and radiated) is the total amount of heat transferred between the instrument units and the spacecraft.
		3.2.2.2.1 Independent Unit - Heat Transfer
	3.2.2.2.1-1	The net heat transfer between the independent unit and spacecraft includes radiation between adjacent instrument and spacecraft surfaces, conduction via the mechanical interface and conduction via the instrument harness.
		3.2.2.2.2 Independent Unit - Net Heat Transfer
GIRD185	3.2.2.2.2-1	For Independent Units, the net heat transfer averaged over the instrument independent unit interface plane area shall be less than 15.5 watts/m ² .
		3.2.2.2.3 Coupled Unit Heat Transfer
GIRD187	3.2.2.2.3-1	The spacecraft shall provide a heat rejection path for thermally coupled units.
		Units with less than 5 watts dissipation may rely on radiative rather than conductive heat rejection subject to agreement of the instrument and spacecraft contractors.
		Where conduction is the principal heat transfer mechanism, the interface temperature is the spacecraft side of the mechanical interface.
		For radiatively-coupled units (accommodated within the spacecraft) the interface temperature is the average local environment surrounding unit external surfaces.
		3.2.2.2.4 Coupled Unit - Net Heat Transfer
GIRD189	3.2.2.2.4-1	The net heat transfer collectively from the instrument's coupled units to the spacecraft shall not exceed the values dictated by the UIID.

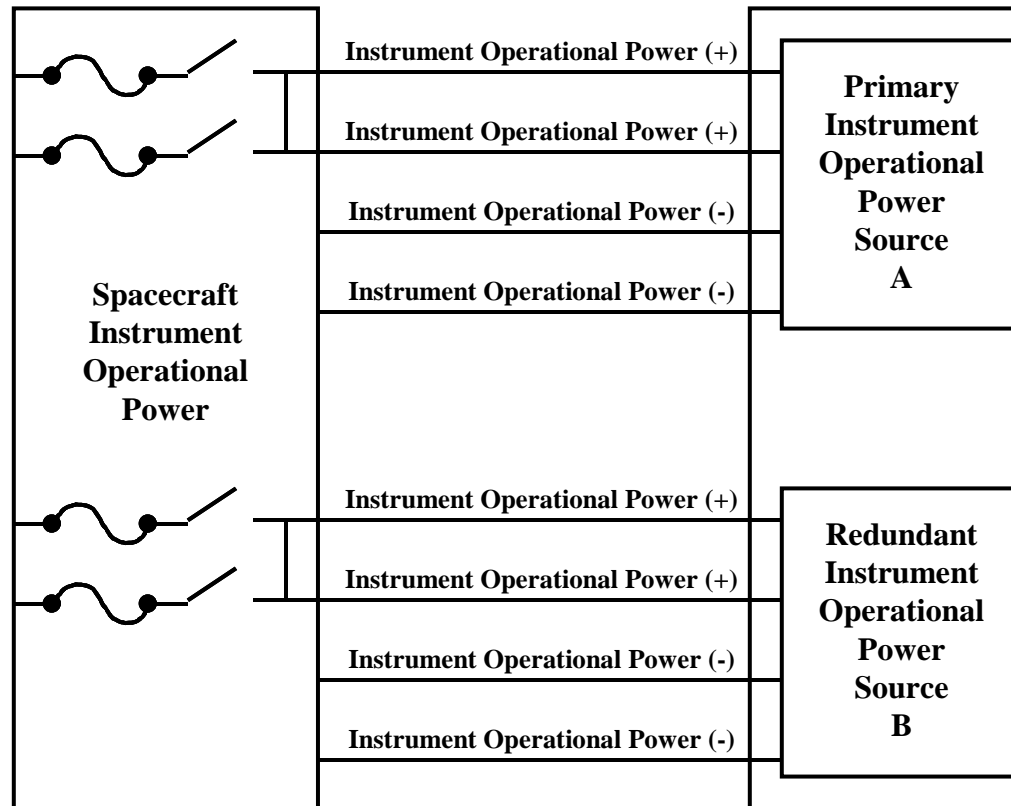
		3.2.2.2.5 Coupled Unit - Heat Transfer Flux Density
GIRD191	3.2.2.2.5-1	For conductively-coupled units, peak local heat transfer fluxes conducted to the spacecraft in excess of 0.25 watts per square centimeter shall be coordinated with the spacecraft contractor and subject to NASA concurrence.
	3.2.2.2.5-2	Where this watt density is exceeded, the spacecraft contractor will provide a detailed description of the heat transport features and SINDA model of the spacecraft side interface.
		3.2.2.3 Interface Temperatures
GIRD201	3.2.2.3-1	For planning and preliminary design purposes, the interface temperature (spacecraft side) for Earth-viewing instruments shall be:
		a) 0°C to 40°C during operation
		b) -30°C to 50°C during non-operation
GIRD202	3.2.2.3-2	If a temperature-controlled nadir platform is employed, the spacecraft shall maintain the temperature of the nadir platform between 25°C ±1°C (TBR) during operations.
		3.2.2.4 Temperature Monitoring
		3.2.2.4.1 Mechanical Interface Temperature Monitoring
	3.2.2.4.1-1	The instrument contractor will select a unit attachment point and identify it on the IDD.
GIRD206	3.2.2.4.1-2	The spacecraft shall have a temperature sensor adjacent to this attachment point (on the spacecraft side) to serve as the interface temperature sensor.
		3.2.2.4.2 Instrument Critical Temperatures
GIRD208	3.2.2.4.2-1	The spacecraft shall convey instrument critical temperatures via the spacecraft telemetry stream.
	3.2.2.4.2-2	The type(s) of temperature sensor and excitation will be collectively selected by the instrument contractor and spacecraft contractor and is subject to NASA concurrence.
	3.2.2.4.2-3	The instrument contractor will procure and install the critical temperature sensors.
	3.2.2.4.2-4	The instrument contractor will furnish temperature calibration coefficients for the critical temperature sensors and document them in the IDD.
		3.2.2.4.3 Instrument Non-Critical Temperatures
GIRD213	3.2.2.4.3-1	The instrument shall report instrument non-critical temperatures in telemetry.
		3.2.2.5 Heater Power and Heater Control

GIRD217	3.2.2.5-1	<p>The two categories of instrument heaters are: Operational heaters controlled by the instrument Non-operational (survival) heaters powered by the spacecraft</p> <p>When the instrument is OFF, the instrument survival heaters shall consume no more than 35% of nominal operational power (of the independent units) averaged over every 72 minute period.</p>
		3.2.2.6 Thermal Interfaces
		3.2.2.6.1 Mounting Details
GIRD221	3.2.2.6.1-1	The spacecraft contractor will document in the ICD properties of any thermally conductive or isolating materials used at the interface of the instrument unit. <i>(CCR 00021)</i>
		3.2.2.6.2 Contact Area
GIRD224	3.2.2.6.2-1	Unit mounting contact area on the instrument and spacecraft shall be unpainted.
		3.2.2.6.3 Interstitial Materials
GIRD226	3.2.2.6.3-1	The spacecraft contractor will integrate the instrument units onto the spacecraft including application of any interstitial materials as conductive enhancements. Selection and application of any interface materials require the concurrence of the instrument contractor and spacecraft contractor.
		3.2.2.7 Multi-layer Insulation
GIRD1080	3.2.2.7-1	Multi-layer insulation (MLI) shall have provisions for electrical grounding to prevent ESD
GIRD1081	3.2.2.7-2	MLI vents shall be located and oriented consistent with observatory contamination requirements.
		3.2.3 Instrument Electrical Power
GIRD230	3.2.3-1	<p>The spacecraft shall supply an instrument operational power bus, and an instrument survival heater power bus to the instrument as specified in the Instrument Electrical Power Figure.</p> <p>The instrument operational power bus is a filtered +28 V power provided by the spacecraft to the instrument to operate the instrument.</p> <p>The instrument survival heater power is TBD V power provided by the spacecraft to the instrument to power the instrument survival heaters.</p>

Instrument Electrical Power Figure**3.2.3.1 Instrument Operational Power****3.2.3.1.1 Instrument Operational Power Distribution****3.2.3.1.1.1 Instrument Operational Power Lines**

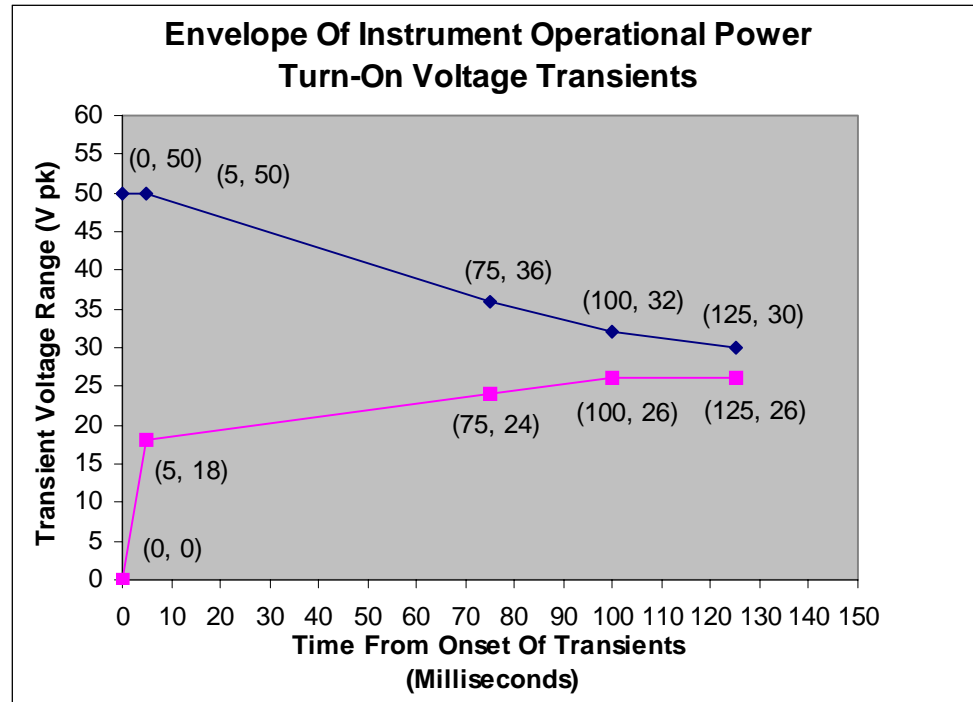
- GIRD233 3.2.3.1.1.1-1 The spacecraft **shall** supply instrument operational power distribution to the instrument operational power input connector for primary and redundant instrument operational power sources as specified in the Operational Power Lines Figure.

Operational Power Lines Figure



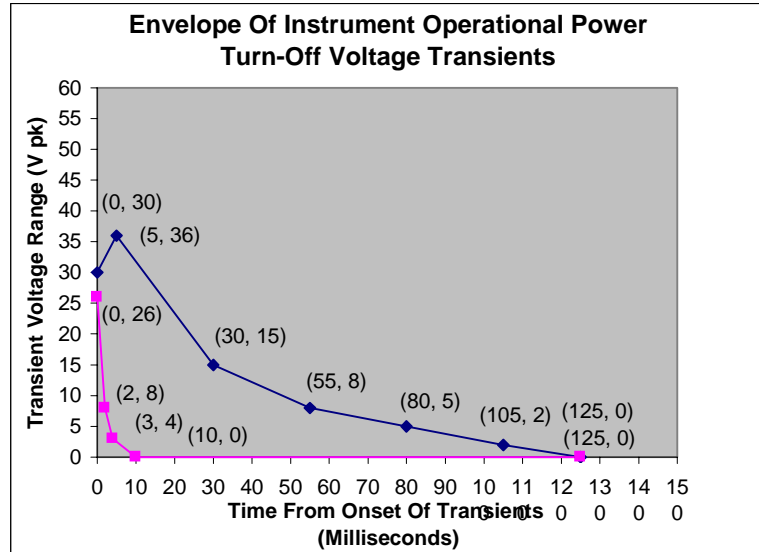
GIRD925	3.2.3.1.1.1-2	The spacecraft shall control the instrument operational power harness voltage drop to less than .50 V roundtrip.
GIRD926	3.2.3.1.1.1-3	The spacecraft shall sense and telemeter the instrument operational power current being supplied to the primary instrument operational power source(s).
GIRD936	3.2.3.1.1.1-4	The spacecraft shall sense and telemeter the instrument operational power current being supplied to the redundant instrument operational power source(s).
3.2.3.1.1.2 Instrument Operational Power On/Off Functionality		
GIRD235	3.2.3.1.1.2-1	The spacecraft shall provide redundant commanding to switch instrument operational power on and off to the instrument operational power input connector.
GIRD236	3.2.3.1.1.2-2	The spacecraft shall provide redundant instrument operational power on and off status telemetry.
GIRD237	3.2.3.1.1.2-3	The spacecraft shall supply redundant switching of instrument operational power to the instrument operational power input connector.
GIRD238	3.2.3.1.1.2-4	The instrument shall accept switched power at the instrument operational power input connector.

3.2.3.1.1.3 Instrument Operational Power Overcurrent Protection		
GIRD240	3.2.3.1.1.3-1	The spacecraft shall protect the instrument operational power harnessing to the instrument operational power input connector from instrument operational power short-to-ground faults.
3.2.3.1.2 Instrument Operational Power DC Voltage		
GIRD242	3.2.3.1.2-1	The spacecraft shall supply a steady-state dc voltage of $28 \text{ Vdc} \pm 2 \text{ Vdc}$ at the instrument operational power input connector.
GIRD243	3.2.3.1.2-2	The instrument shall operate in accordance with the instrument performance specification with a steady-state dc voltage of $28 \text{ Vdc} \pm 2 \text{ Vdc}$ applied at the instrument operational power input connector.
3.2.3.1.3 Instrument Operational Power Voltage Transients		
3.2.3.1.3.1 Instrument Operational Power Turn-On Step Load Voltage Transient		
GIRD246	3.2.3.1.3.1-1	The spacecraft shall control the instrument operational power turn-on step load voltage transient at the spacecraft's instrument operational power connector of the spacecraft's instrument operational power unit(s) to less than or equal to 2 V below the measured steady state dc voltage, and shall recover to its steady state value in less than 5 milliseconds.
GIRD247	3.2.3.1.3.1-2	The spacecraft shall control the instrument operational power turn-on step load voltage transient at the instrument operational power input connector to levels and durations within the voltage transient envelope defined in GIRD249 for any predefined steady state load condition of the operational power unit.
GIRD249	3.2.3.1.3.1-3	The instrument shall meet the instrument performance specification after exposure to the instrument operational power turn-on voltage transients defined in the Envelope of Instrument Operational Power Turn-on Voltage Transients Figure.

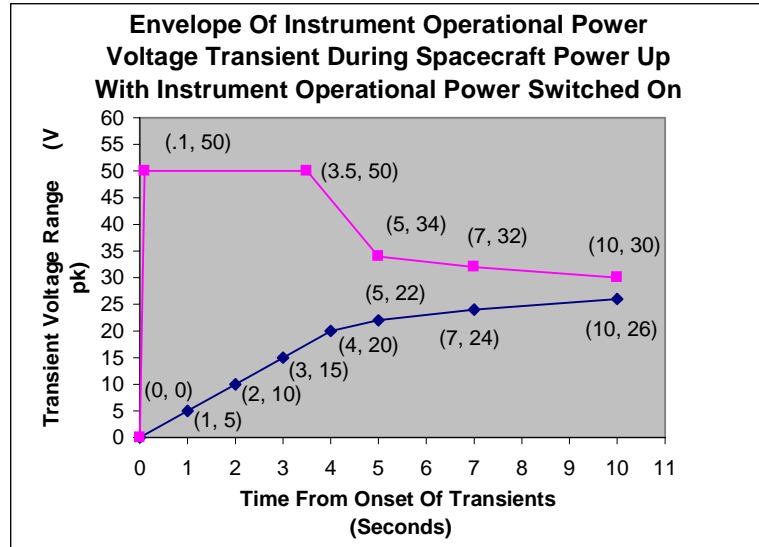


3.2.3.1.3.2 Instrument Operational Power Turn-Off Step Load Voltage Transient

- | | | |
|---------|---------------|---|
| GIRD251 | 3.2.3.1.3.2-1 | The spacecraft shall control the instrument operational power turn-off step load voltage transient at the spacecraft's instrument operational power connector of the spacecraft's instrument operational power unit(s) to less than or equal to 2 V above the measured steady state dc voltage and shall recover to its steady state value in less than 5 milliseconds. |
| GIRD252 | 3.2.3.1.3.2-2 | The spacecraft shall control the instrument operational power turn-off step load voltage transient at the instrument operational power input connector to levels and duration's within the voltage transient envelope defined in the Envelope of Instrument Operational Power Turn-off Voltage Transients Figure for any predefined steady state load condition of the operational power unit. |

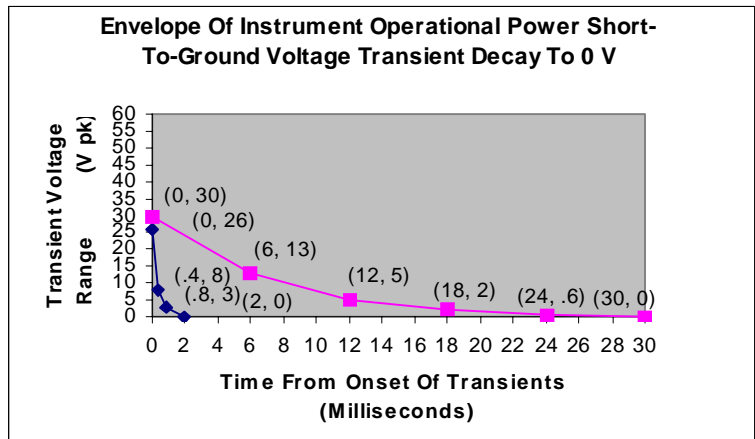
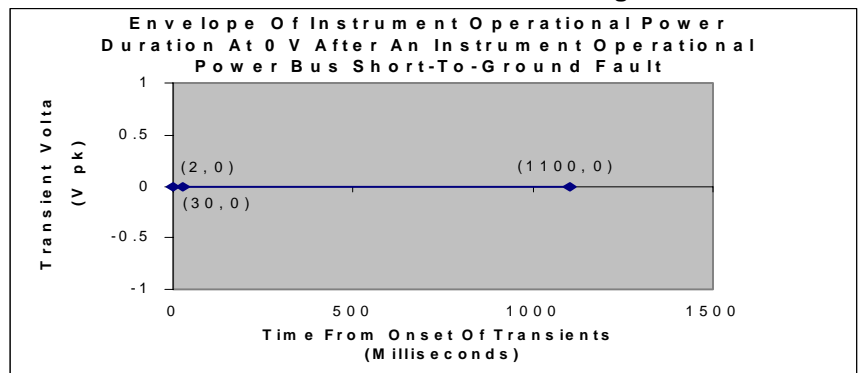
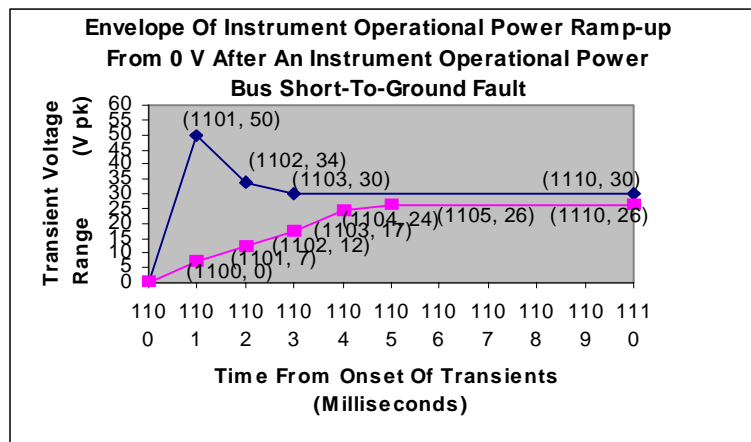


- GIRD254 3.2.3.1.3.2-3 The instrument **shall** meet the instrument performance specification after exposure to the instrument operational power turn-off voltage transients defined in **GIRD252**.
- GIRD256 3.2.3.1.3.3-1 3.2.3.1.3.3 Instrument Operational Power Start-up Transient
During a spacecraft power-up with the instrument operational power switched on, the spacecraft **shall** control the voltage transient at the instrument operational power input connector to levels and duration's within the voltage transient envelope defined in the Envelope of Instrument Operational Power Voltage Transient During Spacecraft Power-up with Instrument Operational Power Switched on Figure.

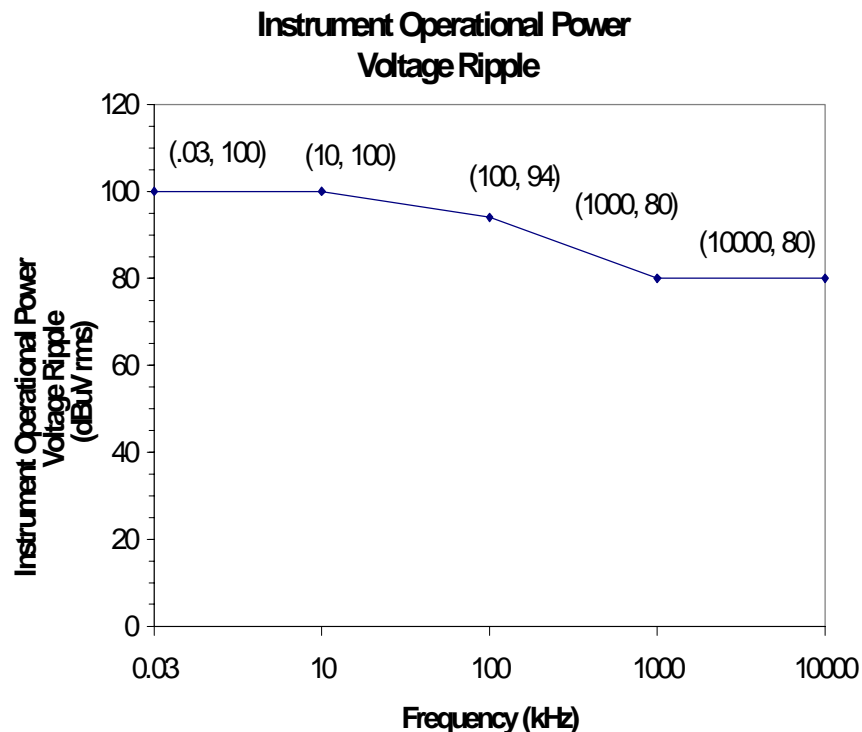


- GIRD257 3.2.3.1.3.3-2 The instrument **shall** meet the instrument performance specification after exposure to the instrument operational power start-up voltage transients defined in GIRD256.
- 3.2.3.1.3.4 Instrument Operational Power Bus Short-to-Ground Voltage Transient
- GIRD259 3.2.3.1.3.4-1 During an instrument operational power bus short-to-ground with the instrument operational power bus drawing its maximum steady-state on-orbit load, the spacecraft **shall** control the instrument operational power bus short to ground voltage transient to levels and duration's within the voltage transient envelopes defined in **GIRD260**.
- GIRD260 3.2.3.1.3.4-2 The instrument **shall** meet the instrument performance specification after exposure to the instrument operational power bus short-to-ground voltage transients defined in the Short to Ground Transient Decay Figure, the Short to Ground Zero Duration Figure, and the Short to Ground Ramp-up Figure.

May 3, 2004

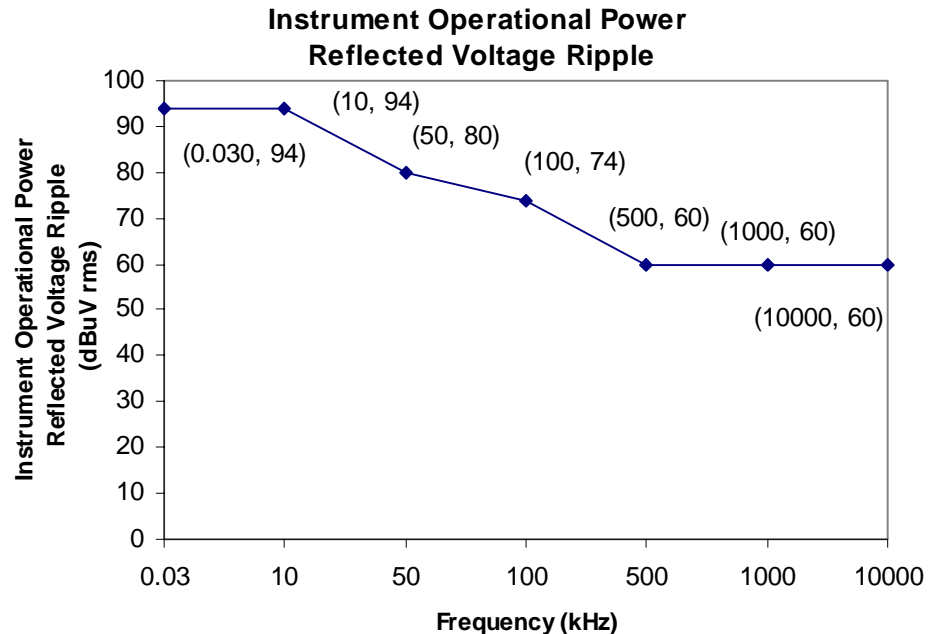
Short to Ground Transient Decay Figure**Short to Ground Zero Duration Figure****Short to Ground Ramp-up Figure**

		3.2.3.1.3.5 Instrument Operational Power Overvoltage Fault Transient
GIRD262	3.2.3.1.3.5-1	The spacecraft shall control an instrument operational power overvoltage fault transient at the instrument operational power input connector to a peak voltage of 40 V.
GIRD263	3.2.3.1.3.5-2	The spacecraft shall recover the instrument operational power to the steady-state instrument operational power dc voltage defined in GIRD243 within 300 milliseconds of an instrument operational power overvoltage fault.
GIRD264	3.2.3.1.3.5-3	The instrument shall meet the instrument performance specification after exposure to the instrument operational overvoltage fault transient defined in GIRD262 .
		3.2.3.1.4 Instrument Operational Power Voltage Ripple
GIRD266	3.2.3.1.4-1	The spacecraft shall control the instrument operational power voltage ripple supplied at the instrument operational power input connector to levels that are at or within those levels specified in the Instrument Operational Power Voltage Ripple Figure for all operating modes with all spacecraft power system buses loaded at their maximum steady-state on-orbit load.



GIRD267	3.2.3.1.4-2	Test measurements shall be in accordance with <u>MIL-STD-461E</u> .
GIRD268	3.2.3.1.4-3	The instrument shall meet the instrument performance specification after exposure to the spacecraft-supplied instrument operational power voltage

- ripple at the instrument operational power input connector that is at or within the levels defined in **GIRD266**.
- GIRD269 3.2.3.1.4-4 The instrument **shall** control its reflected ripple onto the instrument operational power bus for all operating modes when it is drawing its maximum steady-state on-orbit power to levels that are at or within those levels defined in the Instrument Operational Power Reflected Voltage Ripple Figure.

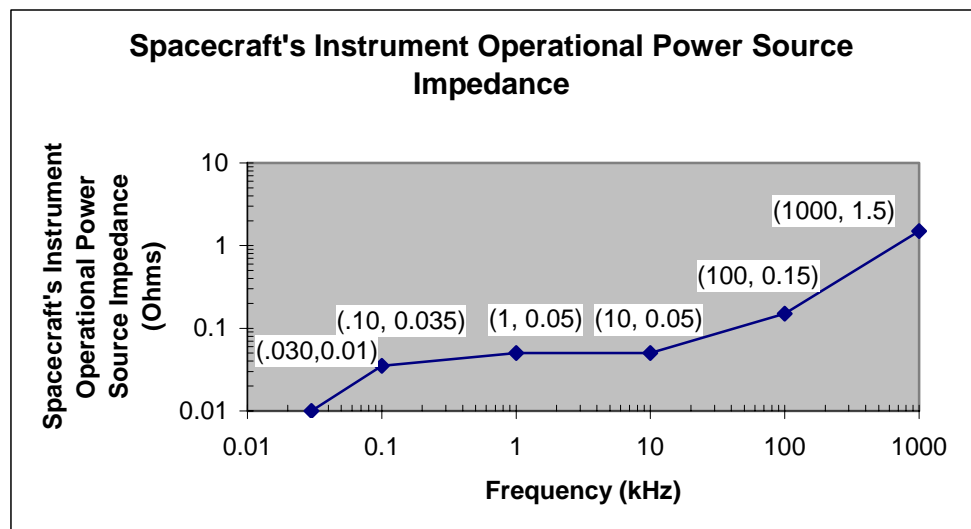


- GIRD270 3.2.3.1.4-5 Test measurements **shall** be in accordance with MIL-STD-461 E.
- 3.2.3.1.5 Instrument Operational Power Consumption
- GIRD272 3.2.3.1.5-1 The spacecraft **shall** satisfy the instrument operational power requirements defined in the UIID.
- GIRD273 3.2.3.1.5-2 The instrument **shall** draw no more than the instrument operational power consumption's defined in the UIID.
- 3.2.3.1.6 Instrument Operational Power Current Transients
- 3.2.3.1.6.1 Instrument Operational Power Turn-On Current Transient
- GIRD278 3.2.3.1.6.1-1 The instrument **shall** limit its instrument operational power turn-on current transient(s) to no more than 6A peak with a ramp-up rate less than 2A/microsecond.
- GIRD928 3.2.3.1.6.1-2 The instrument **shall** control the instrument operational power turn-on current transient(s) within 125% of the maximum steady-state current draw within 20 milliseconds.

GIRD280 3.2.3.1.6.2-1 3.2.3.1.6.2 Instrument Operational Power Turn-Off Current Transient
The instrument **shall** limit its instrument operational power turn-off current transient(s) to no more than 6A peak.

3.2.3.1.7 Instrument Operational Power Impedance

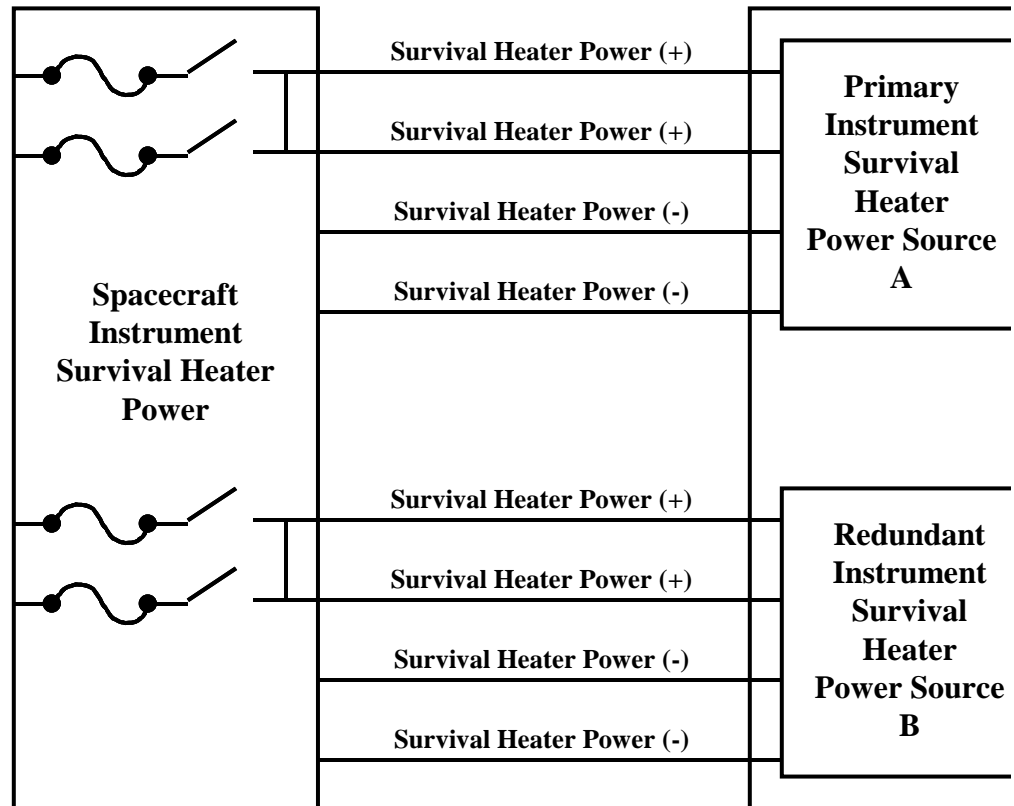
GIRD944 3.2.3.1.7.1-1 3.2.3.1.7.1 Spacecraft's Instrument Operational Power Source Impedance
The spacecraft **shall** control its instrument operational power source impedance within those levels specified in the Spacecraft's Instrument Operational Power Source Impedance Figure.



3.2.3.2 Instrument Survival Heater Power

3.2.3.2.1 Instrument Survival Heater Power Distribution

GIRD346 3.2.3.2.1.1-1 3.2.3.2.1.1 Instrument Survival Heater Power Lines
The spacecraft **shall** supply a single fault tolerant instrument survival heater power distribution to the instrument survival heater power input connector for primary and redundant instrument survival heater power sources as specified in the Survival Heater Power Lines Figure.

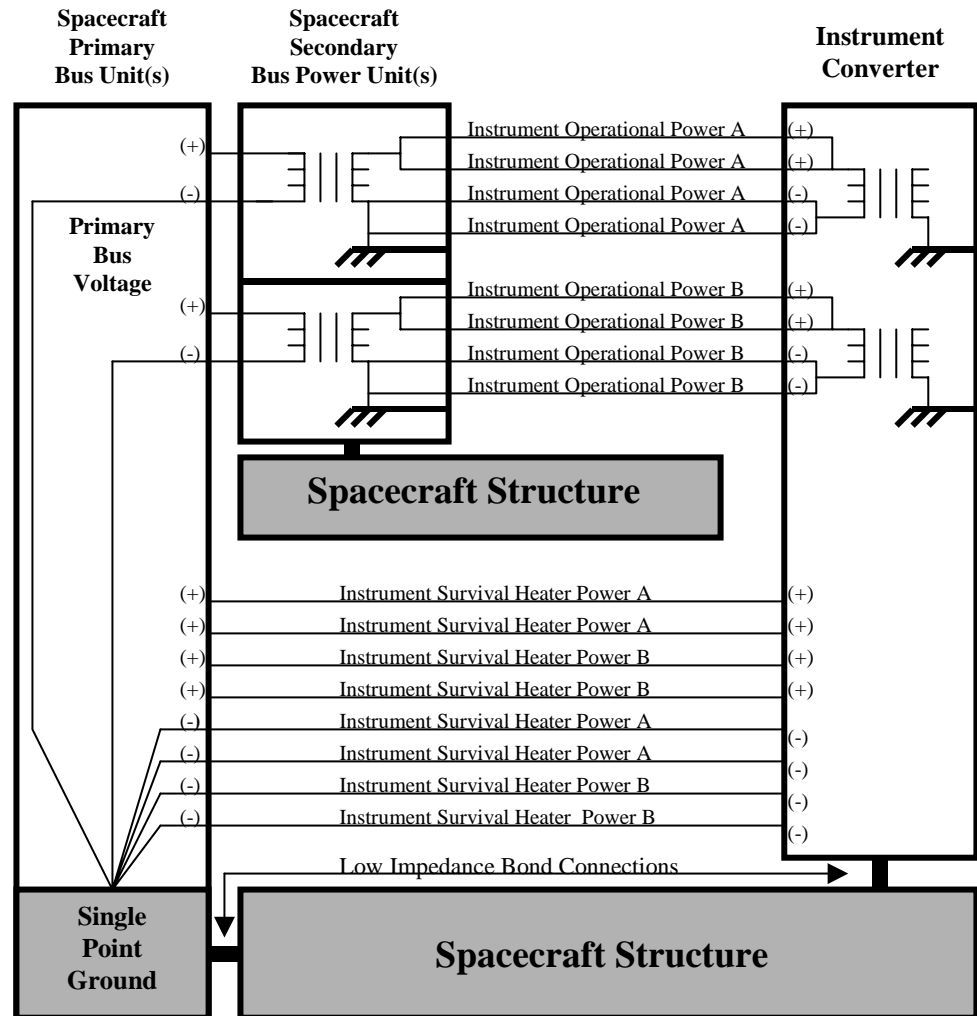
Survival Heater Power Lines Figure

- GIRD347 3.2.3.2.1.1-2 The spacecraft **shall** control the instrument roundtrip survival heater power harness voltage drop to less than 2% of the instrument survival heater power nominal steady state dc voltage.
- 3.2.3.2.1.2 Instrument Survival Heater Power On/Off Functionality
- GIRD349 3.2.3.2.1.2-1 The spacecraft **shall** provide redundant commanding to switch instrument survival heater power ON and OFF to the instrument survival heater power input connector.
- GIRD350 3.2.3.2.1.2-2 The spacecraft **shall** provide redundant instrument survival heater power ON and OFF status telemetry.
- GIRD351 3.2.3.2.1.2-3 The spacecraft **shall** supply redundant switching of instrument survival heater power to the instrument survival heater power input connector.
- GIRD352 3.2.3.2.1.2-4 The instrument **shall** accept switched power at the instrument survival heater power input connector.
- 3.2.3.2.1.3 Instrument Survival Heater Power Overcurrent Protection
- GIRD354 3.2.3.2.1.3-1 The spacecraft **shall** protect the instrument survival heater power harnessing to the instrument survival heater power input connector from instrument survival heater power short-to-ground faults.

		3.2.3.2.2 Instrument Survival Heater Power DC Voltage
GIRD356	3.2.3.2.2-1	The spacecraft shall supply a steady-state dc voltage of TBD Vdc at the instrument survival heater power input connector.
GIRD357	3.2.3.2.2-2	The instrument shall be in accordance with the instrument performance specification with a steady-state dc voltage of TBD Vdc applied at the instrument survival heater power input connector.
		3.2.3.2.3 Reserved (CCR 00009)
		3.2.3.2.3.1 Reserved (CCR 00009)
GIRD360	3.2.3.2.3.1-1	Reserved (CCR 00009)
GIRD361	3.2.3.2.3.1-2	Reserved (CCR 00009)
GIRD362	3.2.3.2.3.1-3	Reserved (CCR 00009)
GIRD363	3.2.3.2.3.1-4	Reserved (CCR 00009)
GIRD365	3.2.3.2.3.2-1	Reserved (CCR 00009)
GIRD366	3.2.3.2.3.2-2	Reserved (CCR 00009)
GIRD367	3.2.3.2.3.2-3	Reserved (CCR 00009)
GIRD368	3.2.3.2.3.2-4	Reserved (CCR 00009)
GIRD370	3.2.3.2.3.3-1	Reserved (CCR 00009)
GIRD371	3.2.3.2.3.3-2	Reserved (CCR 00009)
		3.2.3.2.3.4 Reserved (CCR 00009)
GIRD373	3.2.3.2.3.4-1	Reserved (CCR 00009)
GIRD374	3.2.3.2.3.4-2	Reserved (CCR 00009)
		3.2.3.2.3.5 Reserved (CCR 00009)
GIRD376	3.2.3.2.3.5-1	Reserved (CCR 00009)
GIRD377	3.2.3.2.3.5-2	Reserved (CCR 00009)
GIRD378	3.2.3.2.3.5-3	Reserved (CCR 00009)
		3.2.3.2.4 Reserved (CCR 00009)
GIRD380	3.2.3.2.4-1	Reserved (CCR 00009)
GIRD381	3.2.3.2.4-2	Reserved (CCR 00009)
GIRD382	3.2.3.2.4-3	Reserved (CCR 00009)
GIRD383	3.2.3.2.4-4	Reserved (CCR 00009)
GIRD390	3.2.3.2.4-5	Reserved (CCR 00009)
		3.2.3.2.5 Instrument Survival Heater Power Consumption
GIRD385	3.2.3.2.5-1	The spacecraft shall satisfy the instrument survival heater power requirements defined in the UIID.
GIRD386	3.2.3.2.5-2	The instrument shall draw no more than the instrument survival heater power consumption's defined in the UIID.

		3.2.3.2.6 Reserved (<i>CCR 00009</i>)
		3.2.3.2.6.1 Reserved (<i>CCR 00009</i>)
GIRD392	3.2.3.2.6.1-1	Reserved (<i>CCR 00009</i>)
GIRD930	3.2.3.2.6.1-2	Reserved (<i>CCR 00009</i>)
		3.2.3.2.6.2 Reserved (<i>CCR 00009</i>)
GIRD394	3.2.3.2.6.2-1	Reserved (<i>CCR 00009</i>)
		3.2.3.2.7 Reserved (<i>CCR 00009</i>)
		3.2.3.2.7.1 Reserved (<i>CCR 00009</i>)
GIRD397	3.2.3.2.7.1-1	Reserved (<i>CCR 00009</i>)
		3.2.4 Instrument Electrical Power Grounding
		3.2.4.1 Instrument Operational Power Grounding
GIRD402	3.2.4.1-1	The instrument electrical power grounding shall be in accordance with the Electrical Grounding Figure.

Electrical Grounding Figure



GIRD403	3.2.4.1-2	The spacecraft shall connect each instrument operational power return to the chassis of the spacecraft secondary bus power unit.
GIRD947	3.2.4.1-3	The spacecraft shall connect the spacecraft primary bus return(s) to the spacecraft single point ground.
GIRD1058	3.2.4.1-4	The spacecraft shall control the dc resistance of each primary bus return connection to the single point ground to less than 2.5 milliohm.
GIRD404	3.2.4.1-5	The spacecraft shall control the dc resistance between the spacecraft secondary bus power unit chassis and the spacecraft structure to less than 2.5 milliohm.
GIRD972	3.2.4.1-6	The spacecraft shall supply a low impedance bond connection with a dc resistance of less than 2.5 milliohms between the spacecraft secondary power unit chassis mounted directly to the spacecraft structure.
GIRD405	3.2.4.1-7	The instrument shall isolate the instrument operational power returns from the instrument chassis with a dc resistance greater than 1 megohm.

		3.2.4.2 Instrument Survival Heater Power Grounding
GIRD411	3.2.4.2-1	The spacecraft shall connect each instrument survival heater power return on the instrument connector to the spacecraft primary bus return with a dc resistance of less than 25 milliohm.
GIRD412	3.2.4.2-2	The spacecraft shall connect each primary bus return to the single point ground with a dc resistance of less than 2.5 milliohm for each connector.
GIRD948	3.2.4.2-3	The spacecraft shall supply a low impedance bond connection with a dc resistance of less than 2.5 milliohm between the single point ground and the spacecraft structure.
GIRD413	3.2.4.2-4	The instrument shall isolate the instrument survival heater power returns from the instrument chassis with a dc resistance greater than 1 megohm.
		3.2.4.3 Instrument Secondary Power Grounding
GIRD415	3.2.4.3-1	The instrument shall isolate the instrument secondary power returns from the instrument operational power and instrument survival heater power returns with a dc resistance greater than 1 megohm.
GIRD416	3.2.4.3-2	The spacecraft shall supply a low impedance bond connection with a dc resistance of less than 2.5 milliohm between the spacecraft structure and instrument chassis mounted directly to the spacecraft structure.
GIRD417	3.2.4.3-3	The spacecraft shall supply a low impedance electrical connection with a dc resistance of 2.5 milliohm between the spacecraft structure and instrument chassis mounted on other surfaces than the spacecraft structure.
		3.2.4.4 Instrument Electrical Signal Grounding
		3.2.4.4.1 Instrument Command Grounding
		3.2.4.4.1.1 Instrument Pulse Command Grounding
GIRD952	3.2.4.4.1.1-1	The instrument shall isolate the instrument pulse command returns from the instrument operational power returns, instrument survival heater power returns, instrument secondary power returns and instrument serial command returns with a dc resistance greater than 1 megohm.
		3.2.4.4.1.2 Instrument Serial Command Grounding
GIRD955	3.2.4.4.1.2-1	The instrument shall isolate the instrument serial command returns in accordance with the European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard.
		3.2.4.4.1.3 Instrument Electro-Explosive Device (EED) Command Grounding
GIRD957	3.2.4.4.1.3-1	The instrument shall isolate the instrument EED command returns from the instrument pulse command returns, instrument serial command returns, and instrument secondary power returns with a dc resistance greater than 1

megohm.

3.2.4.4.2 Instrument Telemetry Grounding

3.2.4.4.2.1 Instrument Analog Telemetry Grounding

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| GIRD960 | 3.2.4.4.2.1-1 | The instrument shall isolate low frequency analog telemetry returns with signal frequency characteristics below 1 MHz from the instrument operational power returns, instrument survival heater power returns, instrument pulse command returns, instrument serial command returns, instrument EED command returns, and serial telemetry returns with a dc resistance greater than 1 megohm. |
|---------|---------------|---|

3.2.4.4.2.2 Instrument Serial Telemetry Grounding

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|---------|---------------|---|
| GIRD962 | 3.2.4.4.2.2-1 | The instrument shall isolate the serial telemetry returns in accordance with the European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard. |
|---------|---------------|---|

3.2.4.5 Instrument Electrical Accommodations

3.2.4.5.1 Spacecraft/Instrument Interface Harnessing

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|---------|-------------|--|
| GIRD965 | 3.2.4.5.1-1 | The spacecraft shall supply the required flight harnesses between the instrument and spacecraft. The harness is considered to include the required harness interface connectors, harness wire, harness shielding, insulation wrap, fixing plates, grommets, edge protectors, connector savers, and thermal insulation to make a reliable electrical connection for the entire mission life. |
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3.2.4.5.2 Spacecraft/Instrument Power Interface Harnessing

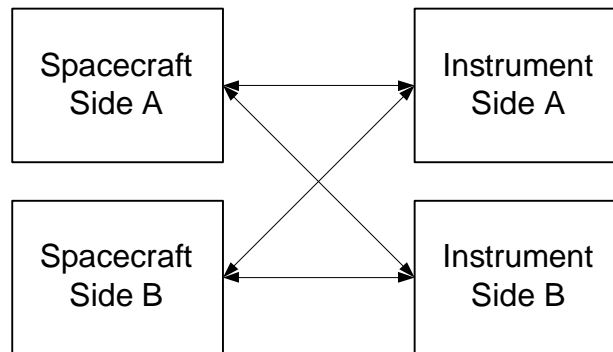
- | | | |
|---------|-------------|--|
| GIRD968 | 3.2.4.5.2-1 | The spacecraft shall utilize harness shielding, harness twisting, and magnetic cancellation techniques to meet the electromagnetic compatibility requirements defined in GIRD934 . |
|---------|-------------|--|

3.2.4.5.3 Spacecraft/Instrument Telemetry & Command Interface Harnessing

- | | | |
|---------|-------------|---|
| GIRD970 | 3.2.4.5.3-1 | The spacecraft shall construct spacecraft/instrument telemetry & command interface harnesses which comply with the <u>European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard</u> . |
| GIRD971 | 3.2.4.5.3-2 | The instrument shall supply the mating connectors to the spacecraft/instrument telemetry & command interface harnesses which comply with the <u>European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard</u> . |

3.2.5 Command and Data Handling

GIRD423	3.2.5.1-1	<p>3.2.5.1 Data Transfer Between the Instrument and Spacecraft</p> <p>All data transferred between the instrument and spacecraft shall use the <u>European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard.</u></p>
GIRD425	3.2.5.2-1	<p>3.2.5.2 SpaceWire Layer Support</p> <p>All data transferred between the instrument and the spacecraft shall use the <u>European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard</u> through the packet layer as a minimum.</p>
GIRD933	3.2.5.2.1-1	<p>3.2.5.2.1 Guaranteed Delivery</p> <p>All data transferred between the instrument and the spacecraft shall provide guaranteed data delivery as defined in <u>GOES R Space Wire Transport Protocol.</u></p>
GIRD427	3.2.5.3-1	<p>3.2.5.3 SpaceWire Data Bus</p> <p>The SpaceWire Data Bus shall be a point-to point communications path.</p>
GIRD978	3.2.5.3.1-1	<p>3.2.5.3.1 SpaceWire Redundancy</p> <p>The SpaceWire bus shall be dual redundant cross-strapped between the instrument and spacecraft as shown in the illustration below.</p>



GIRD429	3.2.5.4-1	<p>3.2.5.4 Source Packet Format</p> <p>All data transferred over the SpaceWire shall use the <u>CCSDS 701.0-B-3 Section 3.3. Source Packet</u> definition shown in the Source Packet Definition Figure.</p>
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Source Packet Definition Figure

PRIMARY HEADER							SECONDARY HEADER	DATA VARIABLE
PACKET IDENTIFICATION				PACKET SEQUENCE CONTROL				
VERSION NUMBER	TYPE	SEC. HDR FLAG	APPLICATION PROCESS ID	SEQUENCE FLAGS	PACKET SEQUENCE COUNT	PACKET LENGTH	TIME CODE AND ANCILLARY DATA	
3 bits	1 bit	1 bit	11 bits	2 bits	14 bits	16 bits	104 bits	
							13 – 8K octets	

GIRD431	3.2.5.4.1-1	3.2.5.4.1 Source Packet Length
		Source packets shall be variable length with a maximum data zone of 8192 octets including Secondary Header.
GIRD433	3.2.5.4.2-1	3.2.5.4.2 Secondary Header Flag
		The Secondary Header Flag shall be set to the value 1.
GIRD435	3.2.5.4.3-1	3.2.5.4.3 Source Packet Secondary Header
		The Source Packet Secondary Header shall be as defined in the Secondary Header Figure.

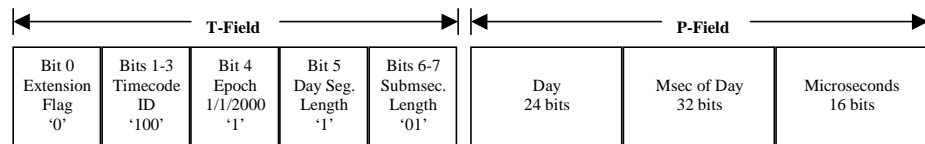
Secondary Header Figure

SECONDARY HEADER	
TIME CODE	USER FLAGS
72 bits	32 bits

GIR437	3.2.5.4.4-1	3.2.5.4.4 Sequence Flags
		The Sequence Flags shall be set to the value of 11. Note: Segmentation services are not permitted.
	3.2.5.4.5-1	3.2.5.4.5 User Defined Flags
		The instrument contractor will define Secondary Header User-Defined Flags in the ICD.

3.2.5.5 SpaceWire Data Rate		
GIRD441	3.2.5.5-1	Data transferred over the SpaceWire data bus shall be clocked at 125Mhz. Note: This clock rate allows for a 100Mbps data rate accounting for SpaceWire overhead.
3.2.5.6 Instrument to Spacecraft Data Volume		
GIRD443	3.2.5.6-1	The volume of instrument data transmitted to the spacecraft shall not exceed the values allocated by the UIID.
3.2.5.7 Pulse Per Second (PPS)		
GIRD445	3.2.5.7-1	The spacecraft shall provide the instrument a 1 PPS time code sequence accurate to ± 10 microseconds relative to UTC.
3.2.5.7.1 SpaceWire Time Code Support		
GIRD447	3.2.5.7.1-1	The 1 PPS time code sequence shall comply with the <u>European Cooperation For Space Standardization (ECSS) ECSS-E50-12A (Space Wire) standard.</u>
3.2.5.7.2 PPS Signal Drift		
GIRD449	3.2.5.7.2-1	The 1 PPS signal shall not drift more than $\pm 1\mu\text{sec}$ over 100 seconds.
3.2.5.7.3 Time Message		
GIRD451	3.2.5.7.3-1	The spacecraft shall transmit a source packet containing the time code to be synchronized by the 1 PPS sequence.
3.2.5.7.4 Time Code Format		
GIRD453	3.2.5.7.4-1	The time code shall comply with the <u>CCSDS 301.B-3 Time Code Formats, Day Segmented format in the Time Code Format Figure.</u>

Time Code Format Figure



Note: The T-Field is implied and not included in the actual time message.

3.2.5.7.5 Epoch		
GIRD455	3.2.5.7.5-1	The time code epoch shall be January 1, 2000.

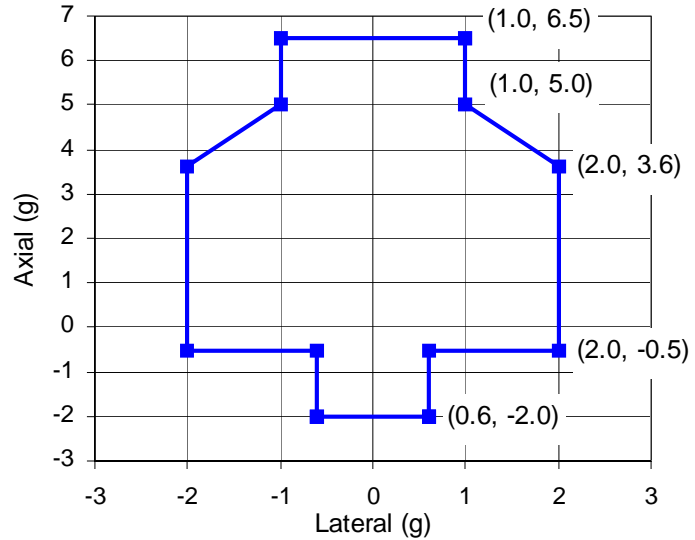
3.2.5.7.6 Distribution Timing

GIRD457	3.2.5.7.6-1	The time message shall be issued between 500 ms and 800 ms before reception of the SpaceWire time code sequence.
		3.2.5.8 Ancillary Data
GIRD459	3.2.5.8-1	The spacecraft shall provide the instruments an ancillary data packet defined in the ICD.
		3.2.5.8.1 Ancillary Packet Rate
GIRD461	3.2.5.8.1-1	The Ancillary Packet shall be transmitted at 100 packets per second.
		3.2.5.9 Control and Monitoring
GIRD463	3.2.5.9-1	All critical telemetry and control services shall be provided by the spacecraft's Remote Interface Unit (RIU). Critical telemetry is defined as telemetry points that are required to monitor the instrument in powered off state. Non-critical telemetry is defined as telemetry points that are required to monitor the instrument in powered on state. Engineering telemetry are data required to process instrument sensor data to higher level products. Housekeeping telemetry are data required to monitor instrument operation, health, and safety.
		3.2.5.9.1 Critical Telemetry
	3.2.5.9.1-1	All temperature and status telemetry required to monitor the health of the instrument will be defined in the ICD.
		3.2.5.9.2 Critical Telemetry Analog Signals
GIRD470	3.2.5.9.2-1	The spacecraft shall provide up to 16 analog signals to monitor critical temperature points to each instrument.
		3.2.5.9.3 Critical Telemetry Analog Signal Resolution
GIRD472	3.2.5.9.3-1	The Critical Telemetry Analog signal resolution shall be 12 bits \pm 0.5 LSB.
		3.2.5.9.4 Discrete Control Signals
GIRD474	3.2.5.9.4-1	The spacecraft shall provide up to 16 discrete pulse control signals to the instrument.
		3.2.5.9.5 Discrete Monitor Signals
GIRD920	3.2.5.9.5-1	The spacecraft shall provide up to 16 discrete instrument monitor lines to each instrument.
		3.2.5.9.6 Critical Telemetry Signal Characteristics
GIRD982	3.2.5.9.6-1	Critical telemetry sensors shall be sourced, from the spacecraft a current

		from 0.1 to 10ma programmable in 0.1ma steps.
		3.2.5.9.7 Discrete Control Signal Characteristics
GIRD984	3.2.5.9.7-1	The spacecraft provided discrete pulse command ON signal shall source 500ma maximum at 28V +/- 3V with 150 msec pulse widths.
		3.2.5.9.8 Discrete Monitor Signal Sink Current
GIRD986	3.2.5.9.8-1	Discrete telemetry points monitored by the spacecraft shall sink 1ma +/-1%.
		3.2.5.9.9 Discrete Monitor ON Status
GIRD988	3.2.5.9.9-1	A Telemetry Discrete Monitor point with a current of 0.8ma or greater shall be considered in the ON state.
		3.2.5.9.10 Discrete Monitor OFF Status
GIRD990	3.2.5.9.10-1	A Telemetry Discrete Monitor point with a current of 0.2ma or less shall be considered in the OFF state.
		3.2.5.9.11 Instrument Configuration Commands
GIRD492	3.2.5.9.11-1	The instrument shall be configurable by spacecraft issued commands. Note: The instrument may also internally configure itself, reporting its configuration via telemetry.
		3.2.5.9.11.1 Configuration Command Definition
	3.2.5.9.11.1-1	The instrument contractor will document instrument configuration commands in the IDD.
		3.2.5.9.12 Stored Command Processing
GIRD980	3.2.5.9.12-1	All stored command processing services shall be provided by the spacecraft.
		3.2.6 Environmental Conditions
		3.2.6.1 On-Orbit Radiation Environment
GIRD935	3.2.6.1-1	The instruments shall comply with the on-orbit radiation requirements that are described in the GSFC document <u>417-R-RPT-0027 titled "The Radiation Environment for Electronic Devices on the GOES-R Series Satellites."</u>
		3.2.6.2 Launch Environment
GIRD577	3.2.6.2-1	The instrument shall be designed to meet the launch environment described herein. The baseline launch vehicle is planned to be an expendable Delta IV or Atlas V.
		3.2.6.2.1 Thermal Environment During Launch
	3.2.6.2.1-1	The fairing inner surface temperatures shall not exceed 150°C for 300

		(TBR) seconds.
	3.2.6.2.1-2	The fairing inner surface shall radiate to the instrument no more than 1240 W/m ² to the instrument for 300 seconds.
	3.2.6.2.1-3	The instantaneous free molecular heating on instrument surfaces in the velocity vector at the time of fairing separation shall not exceed 1135 W/m ² , 3 sigma.
	3.2.6.2.1-4	The duration of free molecular heating shall be limited to 20 (TBR) seconds after fairing separation
		3.2.6.2.2 Pressure Profile
GIRD585	3.2.6.2.2-1	The spacecraft contractor will document in the ICD the predicted launch pressure decay time history obtained from the launch vehicle contractor.
		Inside the launch vehicle fairing, the pressure decays from a maximum of 110 kPa to an orbital minimum of 13 nPa over a period of 100 seconds.
	3.2.6.2.2-2	The depressurization rate shall be less than 2.8 kPa/sec except for a maximum 5 second excursion to 6.2 kPa/sec.
		3.2.6.2.3 Flight Acceleration
GIRD588	3.2.6.2.3-1	Flight limit loads for each instrument unit shall be defined by the spacecraft contractor and recorded in the ICD.
GIRD589	3.2.6.2.3-2	The magnitude of the instrument unit interface forces resolved at the center of mass of the instrument units shall not exceed 15 times 9.81m/s/s times the instrument unit's mass.
	3.2.6.2.3-3	The quasi-static acceleration limit loads for the center of mass of the spacecraft will not exceed the limits plotted in Quasi-Static Spacecraft Center of Mass Limit Loads Figure.

Quasi-Static Spacecraft Center of Mass Limit Loads Figure



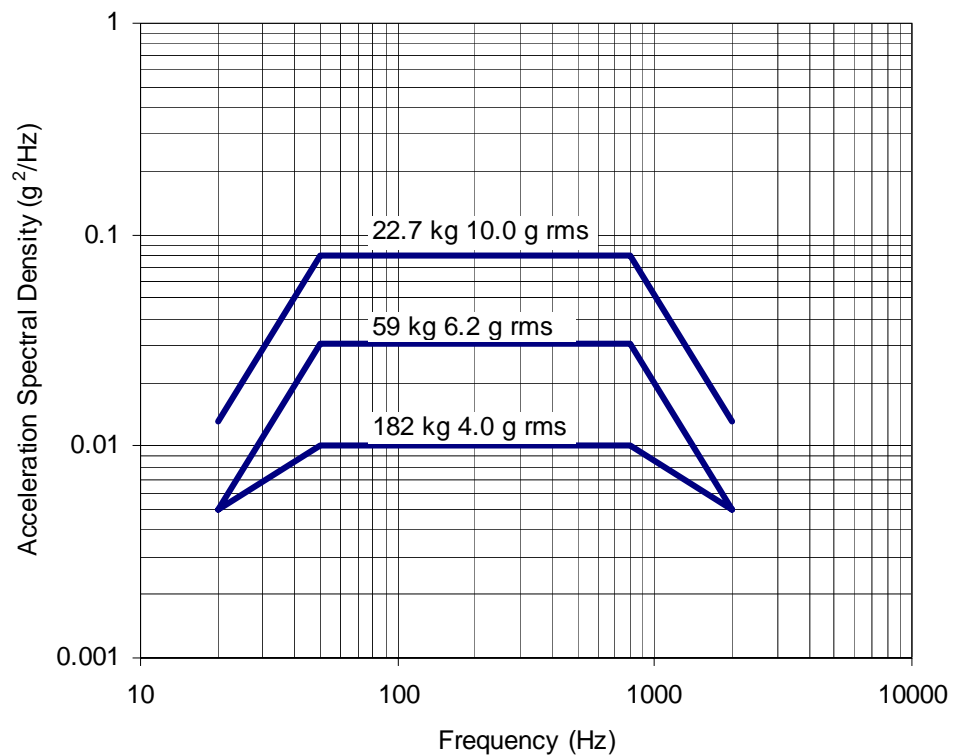
3.2.6.2.4 Flight Random Vibration

GIRD592	3.2.6.2.4-1	Based on the structural vibrations produced by the vibration and acoustic launch environments, the spacecraft contractor will document in the ICD measured or predicted maximum expected flight level random vibration environments for each of the instrument units. Flight levels are equivalent to acceptance levels.
GIRD874	3.2.6.2.4-2	The ASD levels shall not exceed the limits set in GIRD588 and GIRD589 Flight Acceleration.
GIRD593	3.2.6.2.4-3	The maximum expected flight random vibration Acceleration Spectral Density (ASD) for each instrument unit with a mass less than 22.7 kg shall not exceed the limit levels shown in the Flight Limit Acceleration Spectral Densities (ADS) figure in GIRD596 .
GIRD594	3.2.6.2.4-4	For each instrument unit with a mass greater than 22.7 kg and less than 59 kg, the limit ASD levels shall be reduced by a factor of 22.7 kg divided by the mass of the unit in kilograms while maintaining the slope magnitudes at 6 dB per octave.
GIRD595	3.2.6.2.4-5	For each instrument unit with a mass greater than 59 kg and less than 182 kg, the limit ASD levels for the 50 to 800 Hz band shall be reduced by a factor of 22.7 kg divided by the mass of the unit in kilograms while maintaining the 20 and 2000 Hz levels at 0.005 g ² /Hz.
GIRD596	3.2.6.2.4-6	For each instrument unit with a mass greater than 182 kg, the flight ASD levels shall not exceed the limit ASD levels for a 182 kg unit.

The Flight Limit Acceleration Spectral Densities (ASD) Figure plots the limit acceleration spectral densities for units with a mass of 22.7, 59 and 182 kg.

Flight Random Vibration Table

Frequency (Hz)	Units	Component Mass		
	kg	22.7	59	182
20	g^2/Hz	0.013	0.005	0.005
20-50	dB/oct	+6.0	+6.0	+2.3
50-800	g^2/Hz	0.080	0.031	0.010
800-2000	dB/oct	-6.0	-6.0	-2.3
2000	g^2/Hz	0.013	0.005	0.005
Overall	g rms	10.0	6.2	4.0

Flight Limit Acceleration Spectral Densities (ASD) Figure

3.2.6.2.5 Flight Sinusoidal Vibration

GIRD598

3.2.6.2.5-1

Based on the structural response of the spacecraft produced by the maximum expected launch vehicle interface sinusoidal acceleration, the spacecraft contractor will document in the ICD the predicted maximum sinusoidal acceleration response at the interfaces for each of the instrument

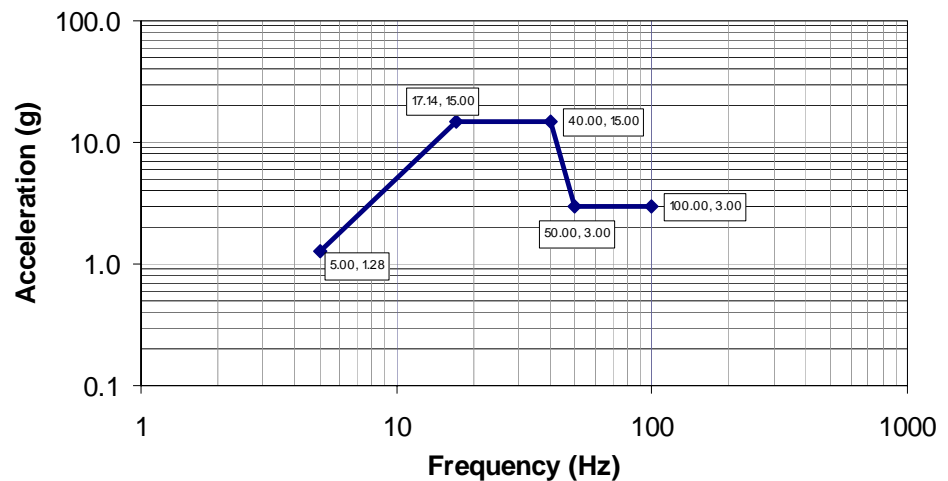
GIRD599

3.2.6.2.5-2

units.

The maximum flight sinusoidal acceleration limit loads at the interfaces for each of the instrument units **shall** not exceed the limits in the Flight Limit Instrument Unit Sinusoidal Accelerations Figure and the limits set in GIRD588 and GIRD589 Flight Acceleration.

Flight Limit Instrument Unit Sinusoidal Accelerations Figure

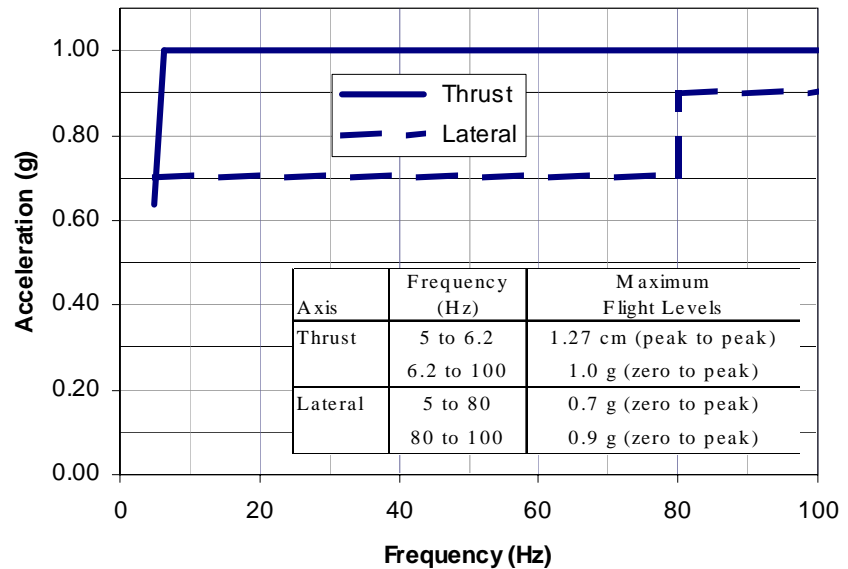


GIRD600

3.2.6.2.5-3

(CCR 00023)

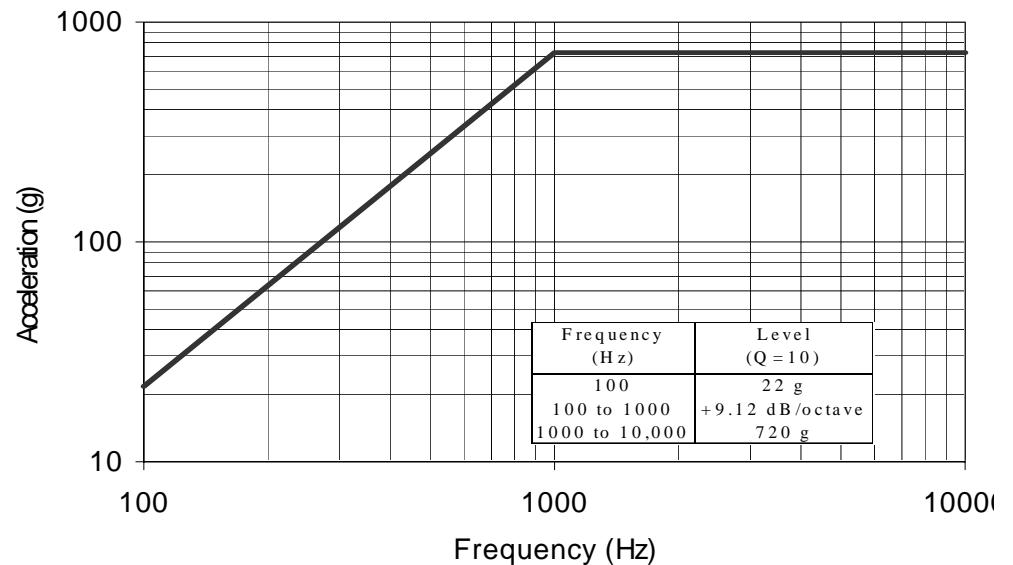
The maximum flight sinusoidal acceleration limit loads at the interface between the spacecraft and the launch vehicle **shall** not exceed the limits plotted in Limit Spacecraft to Launch Vehicle Sinusoidal Accelerations Figure.

Limit Spacecraft to Launch Vehicle Sinusoidal Accelerations Figure**3.2.6.2.6 Shock**

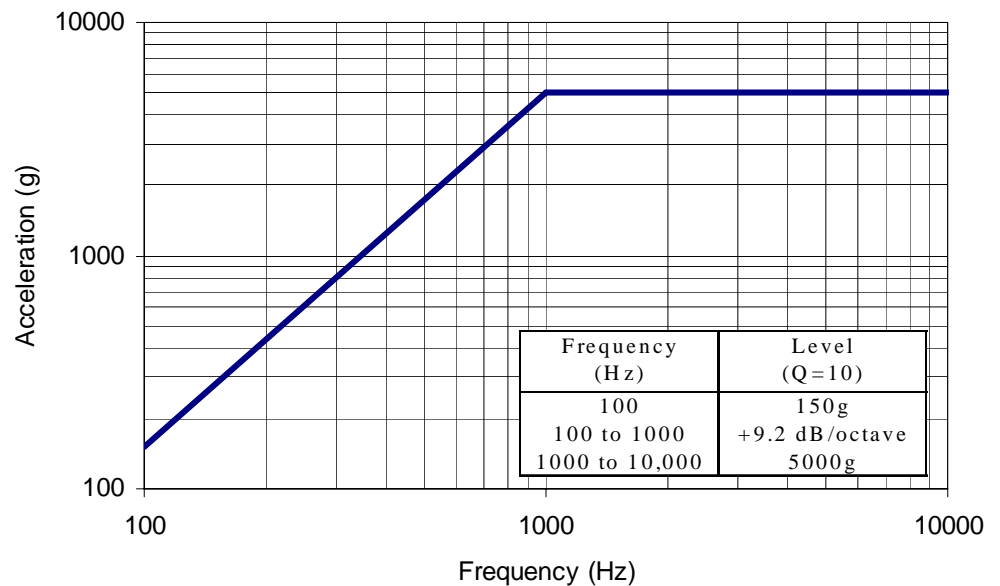
- GIRD602 3.2.6.2.6-1 Based on launch vehicle and spacecraft shock inputs transmitted through spacecraft structure, the spacecraft contractor will document in the ICD the expected shock levels at the interfaces of the instrument units.
- GIRD885 3.2.6.2.6-2 For each instrument unit and for each axis, the flight shock accelerations on the spacecraft side of the instrument to spacecraft interface **shall** produce a peak acceleration response spectra less than the limits set in the Flight Shock Limit Acceleration Response Spectra from the Spacecraft to Instrument Unit Figure when using a quality factor, Q, of 10.

Flight Shock Limit Acceleration Response Spectra from the Spacecraft to Instrument Unit Figure

May 3, 2004



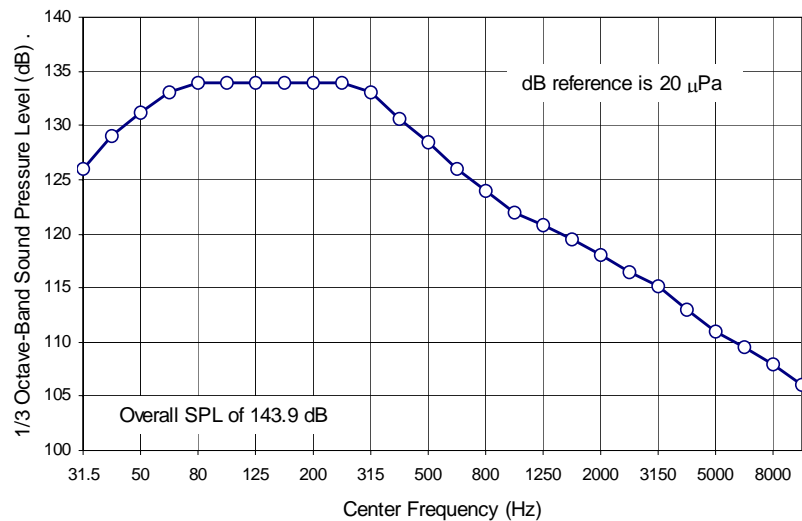
- GIRD886 3.2.6.2.6-3 The flight shock accelerations on the launch vehicle side of the interface between the spacecraft and the launch vehicle **shall** produce a peak acceleration response spectra less than the limits set in the Flight Shock Limit Acceleration Response Spectra from the Launch Vehicle to Spacecraft Figure in **GIRD919** when using a quality factor, Q, of 10.
- 3.2.6.2.6-4 Flight Shock Limit Acceleration Response Spectra from the Launch Vehicle to Spacecraft Figure



		3.2.6.2.7 Flight Acoustics
GIRD605	3.2.6.2.7-1	The spacecraft contractor will document in the ICD the predicted Maximum Expected Flight Level (MEFL) for the acoustic environment with 95 percent probability and with 50 percent confidence.
GIRD606	3.2.6.2.7-2	The MEFL with a 95th percentile and 50 percent confidence shall not exceed the one third octave band limit Sound Pressure Levels (SPL) listed by their center frequencies in the Flight Limit Acoustic Sound Pressure Levels Table and plotted in the Flight Limit Acoustic Sound Pressure Levels Figure.

Flight Limit Acoustic Sound Pressure Levels Table

One-third Octave Bands			
Center Frequency (Hz)	SPL* (dB)	Center Frequency (Hz)	SPL* (dB)
31.5	126.0	630	126.0
40	129.0	800	124.0
50	131.2	1000	122.0
63	133.0	1250	120.7
80	134.0	1600	119.5
100	134.0	2000	118.0
125	134.0	2500	116.5
160	134.0	3150	115.1
200	134.0	4000	113.0
250	134.0	5000	111.0
315	133.0	6300	109.6
400	130.6	8000	108.0
500	128.5	10000	106.0
* Reference pressure is 20 μ Pa		Overall	143.9

Flight Limit Acoustic Sound Pressure Levels Figure

3.2.6.3 On-Orbit Environment

		3.2.6.3.1 Acceleration
GIRD609	3.2.6.3.1-1	Instrument flight hardware shall be designed to withstand a maximum acceleration of 0.040 (TBR) g on orbit without permanent degradation of performance.
		3.2.6.3.2 Orbital Heat Flux
GIRD613	3.2.6.3.2-1	The following orbital heat flux magnitudes shall be assumed.
		3.2.6.3.2.1 Direct Solar Flux
GIRD615	3.2.6.3.2.1-1	The maximum magnitude of direct solar flux to be used shall be 1414 W/m ² ± 5 W/m ² uncertainty occurring at earth perihelion.
GIRD616	3.2.6.3.2.1-2	The minimum magnitude of direct solar flux to be used shall be 1322 W/m ² ± 5 W/m ² uncertainty occurring at earth aphelion. Fluxes on specific dates may use a cosine interpolation between the perihelion and aphelion. (CCR 00021)
		3.2.6.3.2.2 Non-Cryogenic Systems
	3.2.6.3.2.2-1	For non-cryogenic instruments, only solar flux needs to be considered.
		3.2.6.3.2.3 Cryogenic Systems
GIRD620	3.2.6.3.2.3-1	For cryogenic instruments, in addition to solar flux, earth reflected solar flux (albedo flux) and earth radiation shall be considered.
GIRD621	3.2.6.3.2.3-2	Earth reflected solar flux shall be modeled assuming a 0.26 albedo factor (Lambertian earth reflection assumed).
GIRD622	3.2.6.3.2.3-3	Earth IR shall be modeled assuming a 326 W/m ² emitted radiance (at earth's surface), which is equivalent to a 2 ⁰ C black body earth temperature.
		3.2.6.3.2.4 Eclipse
GIRD624	3.2.6.3.2.4-1	Solar Eclipse shall be considered as part of the environmental variation. The Solar Eclipse season occurs twice yearly, with each eclipse season lasting approximately 45 days. The maximum eclipse duration is 72 minutes.
		3.2.6.3.2.5 Lunar Eclipse
GIRD626	3.2.6.3.2.5-1	Lunar Eclipses shall be considered for instrument survivability. Lunar eclipses of 105 minutes maximum duration are rare occurrences.
GIRD627	3.2.6.3.2.5-2	Lunar Eclipses shall not be considered as a nominal operation design case.
		3.3 Attitude and Orbit Data
GIRD 946	3.3-1	All attitude, rate and orbit data shall be included in the spacecraft ancillary data packet.

		3.3.1 Attitude Knowledge
GIRD631	3.3.1-1	The spacecraft shall provide a periodic attitude estimate to the instrument.
		3.3.1.1 Representation
GIRD633	3.3.1.1-1	The attitude estimate shall be a quaternion representation of the attitude of the instrument mounting frame relative to the J2000 inertial reference frame.
		3.3.1.2 Accuracy
GIRD635	3.3.1.2-1	The attitude estimate shall be accurate to within ± 100 microradians, per axis, 3-sigma. This requirement bounds the knowledge error, which is the difference between the estimated attitude and the true attitude.
		3.3.1.3 Update Rate
GIRD637	3.3.1.3-1	The spacecraft shall update the attitude estimate at a rate no less than 1 Hz.
		3.3.1.4 Latency
GIRD639	3.3.1.4-1	The attitude estimate latency shall not exceed 100 milliseconds.
		3.3.2 Spacecraft Angular Rate
GIRD641	3.3.2-1	The spacecraft shall provide a periodic angular rate estimate to the instrument.
		3.3.2.1 Representation
GIRD643	3.3.2.1-1	The spacecraft angular rate data shall be the inertial angular rate of the spacecraft, in units of microradians per second, resolved in the instrument mounting frame defined in GIRD1064 .
		3.3.2.2 Accuracy
	3.3.2.2-1	The accuracy of the spacecraft angular rate estimate is characterized by rate white noise, angle white noise, and the integral of the rate error over a specified time window. The rate error is defined as the difference between the estimated rates and the actual rates of the spacecraft. The integrated rate error includes all residual IRU errors after compensation by the spacecraft and also includes errors due to alignment knowledge error between the IRU input axes and the instrument mounting frame.
GIRD 1068	3.3.2.2-2	The rate white noise component of the spacecraft angular rate estimate shall not exceed a power spectral density (PSD) level of $\sigma_v = 0.05 \mu rad / s^{1/2}$
GIRD 1069	3.3.2.2-3	The angle white noise component of the spacecraft angular rate estimate shall not exceed a power spectral density (PSD) level of $\sigma_e = 0.02 \mu rad / Hz^{1/2}$
GIRD646	3.3.2.2-4	The integrated rate error of the spacecraft angular rate estimate shall not

GIRD647	3.3.2.2-5	exceed ± 0.6 microradians, 3-sigma, per axis, over any 1-second window.
		In addition, the integrated rate error of the spacecraft angular rate estimate shall not exceed ± 2 microradians, 3-sigma, per axis, over any 120-second window.
GIRD648	3.3.2.2-6	In addition, the integrated rate error of the spacecraft angular rate estimate shall not exceed ± 5 microradians, 3-sigma, per axis, over any 300-second window.
3.3.2.3 Bandwidth		
GIRD650	3.3.2.3-1	The spacecraft angular rate estimate shall have a minus 3dB bandwidth of greater than 25 Hz.
GIRD973	3.3.2.3-2	The spacecraft angular rate estimate shall have a second order frequency response.
GIRD974	3.3.2.3-3	The frequency response amplitude of the spacecraft angular rate estimate shall be stable to less than 1% (TBR) from 0.1 to 25 Hz.
GIRD975	3.3.2.3-4	The frequency response phase of the spacecraft angular rate estimate shall be stable to less than 1 degree (TBR) from 0.1 to 25 Hz.
	3.3.2.3-5	The spacecraft contractor will document in the instrument ICD the gyro rate frequency response function from 0 Hz to at least ten times the -3dB gyro bandwidth .
3.3.2.4 Update Rate		
GIRD652	3.3.2.4-1	The spacecraft shall update the angular rate estimate at a rate no less than 100 Hz.
GIRD654	3.3.2.4-2	Spacecraft angular rate sampling shall be uniform to within ± 20 microseconds.
3.3.2.5 Latency		
GIRD655	3.3.2.5-1	The spacecraft angular rate estimate latency shall not exceed 7 milliseconds.
GIRD656	3.3.2.5-2	Spacecraft angular rate latency shall be stable to within ± 20 microseconds.
3.3.3 Spacecraft Orbit		
GIRD658	3.3.3-1	The spacecraft shall provide a periodic spacecraft orbit estimate to the instrument via the ancillary data packet.
3.3.3.1 Representation		
GIRD660	3.3.3.1-1	The spacecraft orbit estimate shall include epoch time and Cartesian position and velocity vectors.
3.3.3.2 Accuracy		
GIRD 662	3.3.3.2-1	The spacecraft position estimate shall be accurate to within ± 300 meters (TBR), 3-sigma, in the in-track (x-axis) and cross-track (y-axis) directions, and accurate to within ± 2 kilometers, 3-sigma, in the radial (z-axis) direction.

GIR 663	3.3.3.2-2	The spacecraft velocity estimate shall be accurate to within ± 1 cm/sec , 3-sigma per axis.
		3.3.3.3 Update Rate
GIRD665	3.3.3.3-1	The spacecraft shall update the orbit estimate at a rate no less than 1 Hz.
		3.3.3.4 Latency
GIRD667	3.3.3.4-1	The spacecraft orbit estimate latency shall not exceed 1 second.
		3.4 Instrument GSE to Spacecraft I&T GSE Interface
GIRD921	3.4-1	Instrument GSE shall receive instrument telemetry via the spacecraft electrical GSE.
GIRD922	3.4-2	Commanding of the instrument shall be from the spacecraft electrical GSE.
		3.5 Contamination Control
		3.5.1 Instrument and Spacecraft Ground Processing
		3.5.1.1 Facility Requirements
GIRD793	3.5.1.1-1	Airborne particle fallout shall not exceed 0.022 percent area coverage (%AC) per month in an ISO 14644 Class 7 facility.
GIRD794	3.5.1.1-2	Airborne particle fallout shall not exceed 0.22 %AC per month in an ISO 14644 Class 8 facility.
GIRD795	3.5.1.1-3	Airborne molecular fallout shall not exceed 0.30 micrograms per square centimeter ($\mu\text{g}/\text{cm}^2$) per month in a cleanroom.
GIRD796	3.5.1.1-4	Airborne Total Hydrocarbons (THC) shall be less than 15 Parts Per Million (PPM) (TBR).
	3.5.1.1-5	Flight hardware will be processed in an ISO 14644-1 Class 7 (TBR) cleanroom or better when contamination sensitive surfaces are exposed.
	3.5.1.1-6	The instrument will be processed in an ISO 14644-1 Class 8 (TBR) cleanroom or better when contamination sensitive surfaces are covered. Optical solar reflectors (OSRs) and solar panels are exceptions. They may be exposed in an ISO 14644-1 Class 8 cleanroom.
	3.5.1.1-7	ISO 14644-1 class conformance will be determined using airborne particle counts larger than $0.5\ \mu\text{m}$ and $5.0\ \mu\text{m}$.
	3.5.1.1-8	Flight hardware will be maintained in a relative humidity environment between 30 and 60%.
		3.5.1.2 Ground Support Equipment Requirements
GIRD801	3.5.1.2-1	The items shall outgas less than 1×10^{-7} g/cm ² -hr (TBR) at 10 K above the maximum survival temperature of the flight hardware that they are tested with when measured with a QCM held at 208 K.
	3.5.1.2-2	Hardware used in vacuum testing will be vacuum-baked prior to use in

		vacuum with flight modules.
	3.5.1.2-3	The items will be baked at 10 K above the maximum survival temperature of the flight hardware that they are tested with.
		3.5.1.3 Purge Requirements
	3.5.1.3-1	The instrument contractor will provide a gas purge to the instrument optical cavity during all storage, test, and transport operations.
GIRD804	3.5.1.3-2	There shall be no more than 500 Parts Per Billion (PPB) Total Hydrocarbons (THC) in the purge gas.
GIRD805	3.5.1.3-3	There shall be no more than 1 Part Per Million (PPM) moisture in the purge gas.
GIRD806	3.5.1.3-4	There shall be no particles larger than 5 micrometers in the purge gas.
	3.5.1.3-5	The instrument contractor will document maximum and minimum acceptable flow rates for the purge gas.
	3.5.1.3-6	The instrument contractor will assume that the purge gas is nitrogen.
		3.5.1.4 Ground Storage/Transportation Requirements
	3.5.1.4-1	During storage and transportation periods, the instrument will be bagged in ESD protective material.
GIRD814	3.5.1.4-2	The ESD protective material shall not transfer more than 0.02 %AC of particles during storage and transport.
GIRD815	3.5.1.4-3	The ESD protective material shall not transfer more 0.30 $\mu\text{g}/\text{cm}^2$ of molecular contamination during storage and transport.
	3.5.1.4-4	Witness samples representative of contamination-sensitive instrument surfaces will be examined and changed when other instrument testing is done during extended storage periods.
		3.5.1.5 Pre-Launch Cleaning Access
	3.5.1.5-1	The spacecraft contractor will provide access to instrument and spacecraft contamination-sensitive surfaces at the launch site for inspection.
	3.5.1.5-2	The spacecraft contractor will provide access to instrument and spacecraft contamination-sensitive surfaces at the launch site for cleaning.
		3.5.2 Mission Considerations
		3.5.2.1 Design
GIRD822	3.5.2.1-1	Multi Layer Insulation (MLI) venting and spacecraft vents shall be directed away from instrument optical ports, instrument thermal control surfaces, and spacecraft thermal control surfaces.
GIRD823	3.5.2.1-2	All MLI joints shall be sealed shut prior launch, so that only the planned vent paths allow outgassed molecular species to escape. This requirement will not supersede any requirement for thermal isolation. It is meant to reduce outgassing in an unplanned direction.
GIRD824	3.5.2.1-3	All instrument and spacecraft components with a direct line of sight to the

		instrument optical and thermal surfaces shall be vacuum baked prior to thermal vacuum testing. Contamination potential is determined by analysis (see Molecular Contamination section).
GIRD825	3.5.2.1-4	All flight hardware bakeouts shall continue until the outgassing rate has been verified with a Quartz Crystal Microbalance (QCM) or other devices approved by NASA to meet the molecular contamination analysis BOL values.
	3.5.2.1-5	The instrument contractor will provide the location of vents in the instrument flight units for inclusion in the ICD.
	3.5.2.1-6	The instrument contractor will provide the size of vents in the instrument flight units for inclusion in the ICD.
	3.5.2.1-7	The instrument contractor will provide the orientation of the vent aperture in the instrument flight units for inclusion in the ICD.
	3.5.2.1-8	The instrument contractor will provide the operation time of vents in the instrument flight units for inclusion in the ICD.
		3.5.2.2 Mission Performance
		3.5.2.2.1 Particulate Contamination
GIRD832	3.5.2.2.1-1	Launch, ascent, and orbit raising shall contribute no more than 0.3% area coverage of particles to any exposed sensitive surface during launch and orbit raising.
		3.5.2.2.2 Molecular Contamination
GIRD834	3.5.2.2.2-1	The spacecraft shall contribute no more than 6 $\mu\text{g}/\text{cm}^2$ nonvolatile residue to instrument thermal control surface apertures, and the instrument optical aperture.
	3.5.2.2.2-2	The instrument contractor will use a density of 1.0 g/cm^3 for all molecular contaminants.
	3.5.2.2.2-3	The instrument contractor will use a transformation value of 0.01 solar absorptance units per 100 Angstroms of NVR on fused quartz optical solar reflectors (OSRs).
GIRD837	3.5.2.2.2-4	The BOL outgassing rates from the molecular contamination analysis for instruments, spacecraft main body, MLI, and the solar array shall be verified using a quartz crystal microbalance. BOL outgassing is the final outgassing rate determined during system-level thermal vacuum testing at the mission high temperature, plus 10 ⁰ C.

3.6 Acronyms

Attachment 1 Document Change Record (DCR)**417-R-GIRD-0009 DCR**

CCR #: 00005 Rev:
Contract #:NNG04HZ07C
CCB Status: **Approved**

CCB Date:12/7/2004
Contract Mod#: **002**
Mod Date:1/12/2005
Contract CD# 001

Title: GIRD Orbit and Body Reference Frames (ORF/BRF)

GOES S/C: R Effectivity: S/C and Instruments
CCR Summary: Clarifies ORF and BRF definitions and makes BRF a requirement.

Doc #: 417-R-GIRD-0009
Doc Section #: GIRD 3.1.4 - 1, 3.1.4 - 2
DOORS Version: GIRD 2.0
DOORS ID: GIRD52, GIRD53

CCR #: 00009 Rev:
Contract #:NNG04HZ07C
CCB Status: **Approved**
CCB Date: 12/7/2004
Contract Mod#: **002**
Mod Date:1/12/2005
Contract CD# 001

Title: Simplification of Survival Heater Power Interface

GOES S/C: R Effectivity: S/C and Instruments
CCR Summary: Simplifies survival heater power requirements.
Doc #: 417-R-GIRD-0009
Doc Section #: GIRD: 3.2.3.2.3, 3.2.3.2.4, 3.2.3.2.6, 3.2.3.2.7
DOORS Version: GIRD 2.0
DOORS ID: GIRD360, 361, 362, 363, 365, 366, 367, 368, 370, 371, 373, 374, 376, 377, 378, 380, 381, 382, 383, 390, 392, 930, 397

CCR #: 00021 Rev:
Contract #:NNG04HZ07C
CCB Status: **Approved**
CCB Date:12/7/2004
Contract Mod#: **002**
Mod Date:1/12/2005
Contract CD# 001

Title: GIRD Typos Cleanup

GOES S/C: R Effectivity: S/C & Instruments
CCR Summary: Corrects typos in the GIRD
Doc #: 417-R-GIRD-0009
Doc Section #: GIRD 3.2.2.6.1, 3.2.6.3.2.1
DOORS Version: GIRD 2.0
DOORS ID: GIRD221 (3.2.2.6.1-1), GIRD616 (3.2.6.3.2.1-2)

CCR #: 00023 Rev:
Contract #: NNG04HZ07C
CCB Status: **Approved**
CCB Date:12/7/2004
Contract Mod#: **002**
Mod Date:1/12/2005
Contract CD# 001

Title: Flight Sinusoidal Vibration Limit Adjustment

GOES S/C: R Effectivity: S/C and Instruments
CCR Summary: Adjusts the Flight Sinusoidal Vibration Limit.
Doc #: 417-R-GIRD-0009
Doc Section #: GIRD 3.2.6.2.5
DOORS Version: GIRD 2.0
DOORS ID: GIRD599 (3.2.6.2.5-2)